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Basic Studies of the Lethality of Shaped Charges
Part I. Penetration Data

Forwarded by:

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O. R. Ottaway

T. M. Finnie

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Basic Studies of the Lethality of Shaped Charges

Part I Penetration Data

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E.G. McMahon }
O.R. Ottaway } (X1)
T.M. Finnie }

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Summary

Trials are described in which a number of designs of shaped charges were fired into semi-infinite armour and against representative tank targets with a view to assessing their anti-tank capabilities. The charges were of 5.9 inches diameter and constant weight and type of explosive. They were fitted with conical liners of various materials, angles and wall thickness.

Part I deals with the firings into semi-infinite armour which were intended to give data on depths of penetration and crater volumes and profiles. The results are presented in detail, and some results from experiments which were carried out to amplify points arising from the main programme are also included.

On the basis of the penetration data, certain designs were selected for firing against standard tripartite target assemblies to determine "beyond armour" fragmentation patterns. This work is described in Part II while the lethality of the charges is assessed and the results discussed in the light of other work in Part III.

Approved for issue:

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CONTENTS

| | Page |
|--|------|
| 1. INTRODUCTION | 1 |
| 2. EXPERIMENTAL | 1 |
| 2.1 Charge Design | 1 |
| 2.2 The targets | 2 |
| 2.3 The firings | 3 |
| 2.4 Measurements | 3 |
| 3. RESULTS | 3 |
| 3.1 Penetration into R.H. armour | 3 |
| 3.2 Penetration into mild steel | 3 |
| 3.3 Comparison of R.H. armour with mild steel | 3 |
| 3.4 Effect of cone parameters on crater profile | 3 |
| 3.5 Effect of stand-off and explosive filling on the crater profile | 3 |
| 3.6 Effect of cone angle on penetration and volume | 4 |
| 3.7 Effect of wall thickness on penetration and volume | 4 |
| 3.8 Comparison between 5.9 in. and 1.625 in. diameter charge | 4 |
| 4. DISCUSSION | 4 |
| 5. CONCLUSIONS | 5 |
| 6. REFERENCES | 6 |
| Tables 3.1 | 7 |
| 3.2 | 8 |
| 3.3 | 8 |
| Appendix A - Penetration data into Rolled Homogeneous Armour | 9 |
| Appendix B - Rolled Homogeneous Armour - physical and chemical parameters. | 36 |
| Appendix C - Penetration data into mild steel | 38 |
| Appendix D - Mild steel - physical and chemical parameters | 43 |
| Figures 1 - 13 | |

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I INTRODUCTION

The investigation described in this report was initiated for the purpose of providing background data for the design of large calibre anti-tank warheads using the shaped charge principle. It has been shown, particularly in work carried out at B.R.L. during the last few years, that the lethality of shaped charge warheads depends primarily on the fragments spalled from the inside surface of the armour, and is not uniquely related to the penetrative ability of the jet, (1,2,3,4,5). Accordingly in the present work the designs investigated included a number which were expected to give relatively low penetration but which it was hoped might prove comparatively lethal:

Each design of charge was fired against semi-infinite armour in order to determine the resulting crater depth and profile. American work had already established certain relations between the crater dimensions and lethality and it was hoped that these might be confirmed and extended by the present work. Those designs which gave very low penetration were not investigated further. The remainder were fired against three types of target, each of which has been agreed, on a tripartite basis, as being representative of modern heavy tank design, (6). For these firings the lethality and distribution of the spalled fragments were measured with a view to assessing the overall lethality of each type of charge. The only variables considered in the charge design were the material, wall thickness and angle of the liner. The cone diameter 5.9 ins., was fixed on the basis that at this calibre most of the charges could be expected to defeat at least one of the tripartite targets.

While the work was in progress a similar series of trials under tripartite sponsorship was carried out at C.A.R.D.E., and has been reported on (7). These trials resulted in a thorough evaluation of the lethality of a very few types of charge, whereas the present trials deal with a much larger number of designs but are less extensive in character. The two sets of results are therefore complementary and use is made of the T.A.T.T.L.E. results in evaluating and discussing the present work.

For convenience of presentation the report is divided into three parts. Part I deals with the experimental details and data obtained from the penetration firings against semi-infinite armour. Part II treats the lethality firings against the tripartite targets in a similar manner, while the main discussion of both sets of results, together with their broader implications is dealt with in Part III.

2. EXPERIMENTAL

2.1 Charge design

The charges were cylindrical in section with a conical metal liner at one end and a central initiating system at the other (Figure 1). The explosive filling was maintained constant at 16lb., excluding the initiating system. This rather large weight was chosen in the interest of reproducibility. Each charge was confined in a mild steel tube of 5.9 ins. internal diameter and 0.125 ins. wall thickness.

2.1.1 The liners

Liners of three different materials were used namely aluminium alloy, copper and steel. These materials had the following specifications:

| | |
|------------------|------------------------|
| Aluminium alloy: | B.S. 1476 H.E. 10 W P. |
| Copper: | B.S. 1433 medium hard. |
| Steel: | B.S. 970 E.N. 3A. |

For each material three cone angles, 45° , 75° and 100° were investigated. The remaining variable parameter was the wall thickness and this was chosen in the case of the copper liners to be 1.5%, 2.5% and 5% of the charge

diameter. The thicknesses of the aluminium and steel liners were determined in such a way that these liners would have the same weight as the corresponding copper liner. A total of 24 designs from the 27 possible combinations of the above parameters were in fact tested.

Each cone was machined from a forging to the dimensions shown in Figure 2, the surface having a good machine finish. It will be observed that in each case the cone was truncated by 20%.

2.1.2 The confinement tube

The confinement was machined from drawn mild steel tube to the required dimensions. The confinement length was adjusted according to the included angle of the liner in order to maintain a constant weight of explosive. Each confinement tube was individually fitted to its cone and the assembly was then locked by three sets of screws which engaged on the base of the cone through the tube.

Two $\frac{1}{4}$ " diameter holes were drilled in the confinement tube level with the apex of the liner. These filled with explosive during the casting operation and thus served to lock the charges in position.

2.1.3 The explosive filling

All except five of the charges were filled with RDX/TNT 60/40, Type A of Bridgwater manufacture. The explosive was cast in air, directly into the cone and tube assembly, an adequate header being provided to eliminate core flaws due to shrinkage. The density of the resultant charge was 1.66 to 1.67 gm/cc.

To allow comparisons to be made with previous work, five of the rounds were filled with Plastic Explosive No.2, hand stemmed to a density of 1.55 gm/cc.

All the charges were radiographed (Figure 3) to detect casting or filling flaws. There was no piping but some cast charges showed fine cracking of the filling around the base of the liner and sometimes lack of adhesion between the liner and explosive filling. Complete elimination of the cracking was never entirely achieved. The charges to be fired were selected on the basis of the radiographs the poorer charges being sent for refilling. The P.E.2 charges showed no major defects.

2.1.4 Initiation

The charges were initiated centrally by means of a Briska No. 8 electric detonator acting through a 1in. diameter by 1 in. long Tetryl Pellet, density 1.58 gm/cc, located in a wooden disc attached to the end of the charge (Figure 1).

2.1.5 Stand-off

Most of the charges were fired at a stand-off distance of 1.5 cone diameters from the target. This distance was adopted to simulate approximately the operational stand-off of an actual weapon. A few rounds were fired at 2 cone diameters stand-off, in order to give a more direct comparison with some of the T.A.T.T.L.E. results.

The stand-off distance was measured from the bottom edge of the confinement tube to the surface of the target (Figure 1).

2.2 The Targets

Rolled homogeneous (R.H.) armour plates of 150mm and 60mm thickness and measuring 6ft x 5ft in area, were assembled in a vertical stack to a height of more than 30 inches. (Figure 4). This arrangement permitted about 30 rounds to be fired in fairly rapid succession, the plates being then separated for measurements on each crater. In this way the effect of plate interfaces on penetration and crater profile was minimised while avoiding the need for cutting and assembling individual targets for each round.

The plates conformed to the specification I.T. 80 E. Their full physical and chemical properties, which were supplied by the manufacturers, are shown in Appendix B. For the sake of comparison a few rounds were also fired against mild steel targets of which the corresponding properties are contained in Appendix D.

2.3 The firings

The charge was mounted vertically above the armour, and at the required stand-off from it, by means of a chipboard support. The support was designed so that only the outer rim of the confinement tube should be in contact with it (Figure 4). Strawboard packs of 3in. thickness were disposed around the charge at a distance of at least 9in. in order to decelerate fragments from the confinement tube, which might otherwise cause a safety hazard.

In order to obtain statistically reliable results five identical firings of a given design were carried out in most cases.

2.4 Measurements

After breaking down the stacks, the craters in individual plates were cleared of liner material. The crater diameter was then measured at 1in. intervals of depth using calibrated calipers, which were specially designed so that the 'toes' would be capable of following shape variations in the profile. At each depth the diameter was measured to an accuracy of 0.05ins. in two directions at right angles.

The plate was then set horizontally by means of a spirit level and the crater volume at one inch intervals of depth obtained by titration. Both diameters and volumes were measured by at least two independent observers.

3. RESULTS

3.1 Penetration into R.H. armour

The round by round penetration data for the R.H. armour firings is shown in Appendix A and is summarised in Table 3.1.

3.2 Penetration into mild steel

For the firings into mild steel targets the round by round data is presented in Appendix C. This data is summarised in Table 3.2.

3.3 Comparison of R.H. armour with mild steel

By combining the results found in Tables 3.1 and 3.2 equivalent values of R.H. armour to mild steel were established. These are shown in Table 3.3.

3.4 Effect of cone parameters on crater profile

The crater profiles resulting from the firings into R.H. armour at 1.5 charge diameters stand-off with RDX/TNT as the explosive filling are shown diagrammatically in Figure 5. These diagrams give a clear comparison of the effects of cone material, angle and wall thickness on the crater profile. The same results are presented graphically in Figure 6, with the intention of emphasising the effect of wall thickness on the crater dimensions.

3.5 Effect of stand-off and explosive filling on the crater profile

The effect on crater profile of increasing the stand-off from 1.5 to 2.0 charge diameters is shown in Figure 7(a) for a copper liner of 45° angle and 0.140in. wall thickness. Figure 7(b) compares the crater obtained using RDX/TNT and P.E.2 for a copper liner of 75° angle and 0.140 wall thickness.

3.6 Effect of cone angle on penetration and volume

For a given material and wall thickness the curves in Figure 8 show how the mean depth of penetration achieved changes with the cone angle. Similarly Figure 9 shows the relation between cone angle and crater volume.

3.7 Effect of wall thickness on penetration and volume

The effects of wall thickness on the depth of penetration and crater volume are shown in Figures 10 and 11 respectively.

3.8 Comparison between 5.9in. and 1.625in. diameter charge

Finally to obtain a comparison between these shaped charges of practical warhead calibre and those previously fired on a laboratory scale, the data from each was scaled by calibre and plotted as crater diameter against depth of penetration into R.H. armour, Figure 12. It should be noted that the charges compared do not scale in all respects. Details of cone and charge parameters are shown on the figure.

4. DISCUSSION

In general the experimental results show good reproducibility with respect to both crater volumes and depths of penetration. This implies that the methods used for preparing the charges were of an acceptable standard and that the liners had been produced within satisfactory tolerances. In particular it is evident that the slight cracking observed radiographically in several of the charges did not significantly affect performance. The thinnest of the 45° copper liners gave results which contrasted markedly with the general reproducibility. Table I shows that the three firings with these liners, which had a wall thickness of 0.088 in. gave penetrations of 22.4 in. 9.9 in. and 13.3 ins., although the crater volumes showed normal scatter. The craters from the two lower penetrations were non-symmetrical indicating malformation of the jet. These liners were machined down from thicker cones and it is natural to suspect this operation as being the cause of the poor performance even though the liners were subjected to the usual tolerances. In any case the scatter is so high that it would be dangerous to draw any positive conclusions from these three results and they are not presented graphically.

Of the three materials investigated it is apparent from Figure 8 that the highest penetration is obtained, in general, with copper followed by steel and then aluminium. Figure 9 shows on the other hand that steel and aluminium give a higher crater volume except in the case of very thick liners. Reference to Figure 6 shows that the higher volume results from a larger crater diameter in the relatively early stages of penetration. From the point of view of lethality however the crater diameter at greater depths of penetration, for example at about 12 in. is a much more important parameter. On the basis of the present results there appears to be no significant effect of liner material on the crater diameter at this depth, provided that the penetration reaches this far.

The effect of cone angle on penetration is clear from Figure 8. In every case there is an increase in penetration with decreasing cone angle and there is every indication that higher penetrations would be obtained at angles smaller than the minimum investigated, namely 45° . The crater volume seems to be almost independent of cone angle, Figure 9. Some increase is perhaps shown at the lowest angle in the case of the thinnest liners. Figure 6 suggests a marginal increase in crater diameter at 12in. depth with increasing cone angle.

In general there is a relatively small increase in penetration when the wall thickness of the liner is decreased, Figure 10. In contrast the crater volume increases markedly with decrease in wall thickness, Figure 12, but there is no indication from Figure 6 of a significant dependance of the crater

diameter at 12in. on the wall thickness. These results, however suggest that the investigation could be profitably extended to thinner liners than those used.

The effect of stand-off is shown only in the two firings of a 45° copper liner, wall thickness 0.140 in. at 2.0 cone diameters stand-off. A 10% increase in penetration and 10% decrease in volume compared with the 1.5 diameter firings resulted. Because of a rather sudden change in crater profile at about 12in. depth in the case of the longer stand-off round Figure 7A it is difficult to say whether there is any significant difference in crater diameter at this point for the two stand-offs. Evidently a fuller investigation of stand-off effects is indicated for the more promising types of design.

Apart from a negligible increase in the mean depth of penetration the main result of using P.E.2 as the explosive filling in place of RDX/TNT 60/40 was a reduction of 13% in crater volume associated with a much reduced crater diameter at the point of entry as shown in Figure 7(b).

When planning the trials it was considered necessary to measure the crater diameter and volume at one inch intervals of penetration to permit comparisons between craters of rapidly changing cross-section, especially those of low depth of penetration. It was subsequently found that most of the craters tapered nearly uniformly so that it was possible to calculate the crater diameter from the volume measurement. Figure 13 compares the results obtained by the two methods. The diameter measurements were made at 1in. intervals, whereas the volume measurements were made over 3in. intervals. It is seen that both methods give overlapping results with comparable scatter and it appears therefore that both methods may be used with equal confidence.

A reasonable minimum criterion for a shaped charge anti-tank warhead is that it should consistently defeat at least 12in. of armour. In the calibre considered here, namely 5.9in. none of the aluminium cones meet this criterion, while the lower angled steel cones and most of the copper cones do meet it. On this basis alone a suitable choice for design would be one of the thinner walled 45° steel cones or any of the 45° or 75° copper cones. It will be seen in Part II how this choice is further limited by lethality considerations.

5. CONCLUSIONS

The techniques used in manufacturing the liners, in filling the charges and in the general assembly and firing procedure were such as to give reliable results.

Copper liners give the greatest depth of penetration followed by steel and aluminium, but the latter two materials give larger crater volumes.

Smaller angle cones give greater depths of penetration, while the crater volume is almost independent of cone angle.

Decreasing the wall thickness of the cone results in a slight increase in penetration and a marked increase in crater volume.

Further work on cones with thinner walls and lower angles is indicated. Reference to Part II shows the importance of adequate penetration at higher stand-offs and extension of some of the present results to stand-off distances up to 8 cone diameters would be desirable.

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TABLE 3.1
PENETRATION INTO R.H. ARMOUR

| Cone Material | Cone Angle | Wall Thickness inches | No. of Rounds | Mean Depth of Penetration | | Scatter of Results | Mean Volume | | Scatter of Results |
|---------------|------------|-----------------------|---------------|---------------------------|-----------|--------------------|-------------|----------|--------------------|
| | | | | ins. | Std. Dev. | | ccs. | Std.Dev. | |
| Copper | 45° | 0.088 | 3 | 15.2 | - | +7.2 -5.3 | 692 | - | +20 -10 |
| | 45° | 0.140 | 5 | 25.3 | 0.54 | +0.8 -0.5 | 650 | 12.6 | +15 -17 |
| | 45° | 0.280 | 5 | 22.1 | 0.87 | +1.5 -0.5 | 396 | 19 | +29 -19 |
| | 75° | 0.088 | 3 | 14.4 | - | +0.5 -1.1 | 660 | - | + 9 - 6 |
| | 75° | 0.140 | 5 | 16.9 | 0.54 | +0.9 -0.5 | 553 | 20.5 | +27 -30 |
| | 75° | 0.280 | 5 | 14.9 | 0.32 | +0.6 -0.2 | 378 | 17 | +25 -21 |
| | 100° | 0.140 | 5 | 10.8 | 0.51 | +0.9 -0.4 | 599 | 19 | +31 -16 |
| | 100° | 0.280 | 5 | 12.5 | 0.38 | +0.6 -0.3 | 403 | 11.4 | +20 - 8 |
| Steel | 45° | 0.100 | 5 | 16.3 | 0.93 | +0.9 -1.5 | 788 | 45.6 | +64 -54 |
| | 45° | 0.160 | 5 | 15.2 | 0.98 | +1.7 -0.8 | 543 | 19.5 | +16 -32 |
| | 45° | 0.320 | 5 | 12.3 | 0.36 | +0.5 -0.3 | 305 | 12 | +16 -13 |
| | 75° | 0.100 | 5 | 12.7 | 0.45 | +0.7 -0.5 | 676 | 37.3 | +25 -66 |
| | 75° | 0.160 | 5 | 12.3 | 0.24 | +0.4 -0.2 | 520 | 36 | +51 -42 |
| | 75° | 0.320 | 5 | 10.0 | 1.1 | +2.0 -0.8 | 295 | 18.8 | +19 -21 |
| | 100° | 0.100 | 5 | 10.8 | 0.31 | +0.4 -0.4 | 670 | 20.4 | +19 -35 |
| | 100° | 0.160 | 5 | 10.3 | 0.1 | +0.1 -0.1 | 607 | 15.0 | +19 -20 |
| | 100° | 0.320 | 5 | 8.4 | 0.38 | +0.6 -0.4 | 320 | 9.6 | +14 -12 |
| Aluminium | 45° | 0.300 | 5 | 11.8 | 0.41 | +0.4 -0.5 | 813 | 14.6 | +19 -14 |
| | 45° | 0.470 | 5 | 10.9 | 0.44 | +0.5 -0.5 | 594 | 26 | +25 -42 |
| | 45° | 0.940 | 5 | 8.6 | 0.17 | +0.2 -0.2 | 220 | 7.6 | + 8 -11 |
| | 75° | 0.300 | 5 | 8.0 | 0.66 | +0.8 -0.6 | 675 | 21.2 | +35 -22 |
| | 75° | 0.470 | 5 | 7.0 | 0.09 | +0.1 -0.1 | 457 | 28 | +21 -50 |
| | 75° | 0.940 | 5 | 6.2 | 0.09 | +0.1 -0.1 | 185 | 15.7 | +20 -15 |
| | 100° | 0.940 | 5 | 4.7 | 0.22 | +0.1 -0.4 | 165 | 15.1 | +19 -15 |

TABLE 3.2
PENETRATION INTO MILD STEEL

| Cone Material | Cone Angle | Wall Thickness inches | No. of Rounds | Mean Depth of Penetration | | Scatter of Results | Mean Volume | | Scatter of Results |
|---------------|------------|-----------------------|---------------|---------------------------|----------|--------------------|-------------|----------|--------------------|
| | | | | ins. | Std.Dev. | | ccs. | Std.Dev. | |
| Steel * | 75° | 0.160 | 5 | 15.0 | 0.61 | +0.8 -0.6 | 1013 | 59 | +75 -67 |
| | 100° | 0.160 | 5 | 12.5 | 0.4 | +0.5 -0.5 | 1260 | 51 | +32 -76 |
| Aluminium | 45° | 0.940 | 5 | 12.2 | 0.09 | +0.1 -0.1 | 375 | 23.6 | +24 -39 |
| | 75° | 0.940 | 4 | 8.6 | 0.22 | +0.2 -0.3 | 336 | 17.8 | +25 -16 |
| | 100° | 0.940 | 3 | 6.1 | - | +0.2 -0.2 | 302 | - | +19 -16 |

TABLE 3.3
COMPARISON OF R.H. ARMOUR WITH MILD STEEL

| Cone Material | Cone Angle | Wall Thickness inches | R.H. Armour/Mild Steel | |
|---------------|------------|-----------------------|------------------------|--------|
| | | | Penetration | Volume |
| Steel | 75° | 0.160 | 0.82 | 0.51 |
| | 100° | 0.160 | 0.82 | 0.48 |
| Aluminium | 45° | 0.940 | 0.71 | 0.59 |
| | 75° | 0.940 | 0.72 | 0.55 |
| | 100° | 0.940 | 0.77 | 0.55 |

APPENDIX AContents: Round-by-round penetration data into R.H. Armour

| <u>Table Number</u> | <u>Liner Details</u> | <u>Remarks</u> |
|---------------------|-----------------------------|--------------------|
| 1 | Copper 45° 0.088 inches | |
| 2 | Copper 45° 0.140 inches | 1.5 C.D. stand-off |
| 2A | Copper 45° 0.140 inches | 2.0 C.D. stand-off |
| 3 | Copper 45° 0.280 inches | |
| 4 | Copper 75° 0.088 inches | |
| 5 | Copper 75° 0.140 inches | RDX/TNT 60/40 |
| 5A | Copper 75° 0.140 inches | P.E.2 |
| 6 | Copper 75° 0.280 inches | |
| 7 | Copper 100° 0.140 inches | |
| 8 | Copper 100° 0.280 inches | |
| 9 | Steel 45° 0.100 inches | |
| 10 | Steel 45° 0.160 inches | |
| 11 | Steel 45° 0.320 inches | |
| 12 | Steel 75° 0.100 inches | |
| 13 | Steel 75° 0.160 inches | |
| 14 | Steel 75° 0.320 inches | |
| 15 | Steel 100° 0.100 inches | |
| 16 | Steel 100° 0.160 inches | |
| 17 | Steel 100° 0.320 inches | |
| 18 | Aluminium 45° 0.300 inches | |
| 19 | Aluminium 45° 0.470 inches | |
| 20 | Aluminium 45° 0.940 inches | |
| 21 | Aluminium 75° 0.300 inches | |
| 22 | Aluminium 75° 0.470 inches | |
| 23 | Aluminium 75° 0.940 inches | |
| 24 | Aluminium 100° 0.940 inches | |

FILLING
RDX/TNT 60/40

LINER
Material: Copper
Cone Angle : 45°
Wall thickness : 0.088 inches

TARGET
R.H. ARMOUR

| Round No. | | P157 | | P158 | | P159 | | | | | | Mean Hole Diam. ins. | Mean Residual Volume ccs. |
|--|-----|--------------------------|-----------------------|--------------|-----------------------|---------------|-----------------------|--------------|-----------------------|--------------|-----------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 46, 58, 59, 60, 61 | | 46, 58 | | 46, 58, 59 | | | | | | | |
| Depth of Penetration | | Hole Diam. | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mm. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Crater | | | 712 | | 682 | | 683 | | | | | | 692 |
| 0 | 0 | 3.1 | 655 | 3.5 | 622 | 3.8 | 626 | | | | | 3.5 | 634 |
| 1 | 25 | 2.6 | 555 | 2.5 | 515 | 2.8 | 514 | | | | | 2.6 | 528 |
| 2 | 51 | 2.3 | 478 | 2.2 | 438 | 2.6 | 418 | | | | | 2.4 | 445 |
| 3 | 76 | 2.2 | 411 | 2.2 | 366 | 2.3 | 344 | | | | | 2.2 | 374 |
| 4 | 102 | 2.2 | 351 | 2.3 | 299 | 2.4 | 271 | | | | | 2.3 | 307 |
| 5 | 127 | 2.2 | 280 | 2.4 | 226 | 2.2 | 182 | | | | | 2.3 | 229 |
| 6 | 152 | 1.8 | 223 | 2.0 | 161 | 1.6 | 138 | | | | | 1.8 | 174 |
| 7 | 178 | 1.3 | 187 | 1.6 | 121 | 1.3 | 103 | | | | | 1.4 | 137 |
| 8 | 203 | 1.2 | 168 | 1.2 | 35 | 1.2 | 83 | | | | | 1.2 | 95 |
| 9 | 228 | 1.2 | 149 | 0.8 | 15 | 1.2 | 64 | | | | | 1.1 | 76 |
| 10 | 254 | 1.2 | 131 | 0.7 | 0 | 1.2 | 45 | | | | | 1.0 | 59 |
| 11 | 279 | 1.1 | 110 | | | 1.0 | 25 | | | | | | |
| 12 | 304 | 1.1 | 91 | | | 0.8 | 9 | | | | | | |
| 13 | 330 | 1.0 | 80 | | | 0.7 | 2 | | | | | | |
| 14 | 355 | 0.9 | 70 | | | 0.6 | 0 | | | | | | |
| 15 | 381 | 0.9 | 60 | | | | | | | | | | |
| 16 | 406 | 0.8 | 52 | | | | | | | | | | |
| 17 | 431 | 0.7 | 41 | | | | | | | | | | |
| 18 | 456 | 0.8 | 32 | | | | | | | | | | |
| 19 | 482 | 0.8 | 24 | | | | | | | | | | |
| 20 | 508 | 0.8 | 18 | | | | | | | | | | |
| 21 | 533 | 0.6 | 9 | | | | | | | | | | |
| 22 | 558 | 0.6 | 2 | | | | | | | | | | |
| 23 | 583 | 0.4 | 0 | | | | | | | | | | |
| Total Depth of Penetration Inches | | 22.4 | | 9.9 | | 13.3 | | | | | | Mean Total Depth ins. 15.2 | |
| | | | | | | | | | | | | Standard Deviation - | |
| Total volume ccs. | | 712 | | 682 | | 683 | | | | | | Mean Volume ccs. 692 | |
| | | | | | | | | | | | | Standard Deviation - | |

FILLING
RDX/TNT 60/40

LINER
Material: Copper
Cone Angle: 45°
Wall thickness: 0.140 inches

TARGET
R.H. ARMOUR
Stand off: 1.5 C.D.

| Round No. | | P51 | | P52 | | P83 | | P84 | | P107 | | Mean Hole Diam. ins. | Mean Residual Volume ccs. |
|-----------------------------------|------|-------------------------------|-----------------|-------------------------------|-----------------|-------------------------------|-----------------|-------------------------------|-----------------|-------------------------------|-----------------|---|---------------------------|
| Plate Nos. | | 24,25,26 27,28,29 30,31 | | 24,25,26 27,28,29 30,31 | | 24,25,26 27,28,29 30,31 | | 24,25,26 27,28,29 30,31 | | 33,46,23 31,30,29 28,47 | | | |
| Depth of Penetration | | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mms. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Crater: | | | 633 | | 665 | | 659 | | 644 | | 651 | | 650 |
| 0 | 0 | 3.1 | 603 | 3.1 | 625 | 3.1 | 609 | 2.9 | 608 | 3.3 | 602 | 3.1 | 609 |
| 1 | 25 | 2.9 | 498 | 2.3 | 537 | 2.3 | 507 | 2.2 | 528 | 2.8 | 510 | 2.5 | 516 |
| 2 | 51 | 2.2 | 437 | 2.3 | 482 | 2.1 | 444 | 2.0 | 478 | 2.3 | 437 | 2.2 | 456 |
| 3 | 76 | 2.0 | 370 | 2.1 | 417 | 2.0 | 382 | 2.1 | 418 | 2.0 | 379 | 2.0 | 393 |
| 4 | 102 | 1.8 | 323 | 2.0 | 353 | 2.0 | 334 | 2.0 | 358 | 2.0 | 320 | 2.0 | 338 |
| 5 | 127 | 1.6 | 282 | 1.9 | 310 | 1.9 | 282 | 1.9 | 313 | 1.8 | 272 | 1.8 | 292 |
| 6 | 152 | 1.5 | 243 | 1.6 | 260 | 1.6 | 239 | 1.6 | 258 | 1.5 | 231 | 1.6 | 246 |
| 7 | 178 | 1.3 | 224 | 1.5 | 230 | 1.3 | 209 | 1.4 | 215 | 1.3 | 199 | 1.4 | 215 |
| 8 | 203 | 1.3 | 202 | 1.3 | 206 | 1.3 | 185 | 1.3 | 194 | 1.2 | 177 | 1.3 | 193 |
| 9 | 228 | 1.3 | 182 | 1.3 | 188 | 1.3 | 165 | 1.3 | 172 | 1.2 | 159 | 1.3 | 173 |
| 10 | 254 | 1.3 | 164 | 1.3 | 168 | 1.3 | 145 | 1.3 | 155 | 1.2 | 139 | 1.3 | 154 |
| 11 | 279 | 1.3 | 141 | 1.3 | 145 | 1.2 | 135 | 1.2 | 135 | 1.2 | 124 | 1.2 | 136 |
| 12 | 304 | 1.2 | 120 | 1.2 | 119 | 1.2 | 105 | 1.2 | 114 | 1.1 | 104 | 1.2 | 112 |
| 13 | 330 | 1.0 | 106 | 1.0 | 106 | 1.0 | 91 | 1.0 | 100 | 0.8 | 89 | 1.0 | 98 |
| 14 | 355 | 1.0 | 93 | 0.9 | 97 | 1.0 | 85 | 0.9 | 90 | 0.8 | 79 | 0.9 | 89 |
| 15 | 381 | 0.8 | 76 | 0.8 | 80 | 0.8 | 68 | 0.8 | 74 | 0.6 | 69 | 0.8 | 73 |
| 16 | 406 | 0.8 | 66 | 0.7 | 72 | 0.8 | 62 | 0.8 | 65 | 0.7 | 62 | 0.8 | 65 |
| 17 | 431 | 0.7 | 60 | 0.7 | 64 | 0.6 | 55 | 0.7 | 61 | 0.6 | 51 | 0.7 | 58 |
| 18 | 456 | 0.7 | 54 | 0.6 | 59 | 0.6 | 49 | 0.9 | 55 | 0.7 | 46 | 0.7 | 53 |
| 19 | 482 | 0.8 | 47 | 1.0 | 52 | 0.6 | 43 | 0.7 | 47 | 0.7 | 41 | 0.8 | 46 |
| 20 | 508 | 0.7 | 39 | 0.6 | 47 | 0.7 | 37 | 0.6 | 40 | 0.6 | 34 | 0.6 | 39 |
| 21 | 533 | 0.7 | 32 | 0.7 | 38 | 0.7 | 30 | 0.7 | 35 | 0.6 | 29 | 0.7 | 33 |
| 22 | 558 | 0.6 | 22 | 0.7 | 29 | 0.6 | 26 | 0.7 | 30 | 0.5 | 22 | 0.6 | 26 |
| 23 | 583 | 0.7 | 19 | 0.8 | 22 | 0.5 | 21 | 0.7 | 22 | 0.5 | 20 | 0.6 | 21 |
| 24 | 609 | 0.8 | 10 | 0.8 | 12 | 0.7 | 16 | 0.8 | 14 | 0.6 | 12 | 0.7 | 13 |
| 25 | 634 | | 0 | | 0 | 0.7 | 5 | | 0 | 0.6 | 7 | | 2.5 |
| 26 | 660 | | | | | | 0 | | | 0.6 | 0 | | |
| Total Depth of Penetration Inches | | 25.0 | | 24.8 | | 25.6 | | 25.0 | | 26.1 | | Mean Total Depth ins. 25.3 Standard Deviation 0.54 | |
| Total Volume ccs. | | 633 | | 665 | | 659 | | 644 | | 651 | | Mean Volume ccs. 650 Standard Deviation 12.6 | |

FILLINGLINERTARGET

RDX/TNT 60/40

Material:
Cone Angle;
Wall thickness;Copper
45°
0.140 inchesR.H. Armour
Standoff: 2 C.D.

| Round No. | | 130 | | 131 | | | | | | | | Mean Hole Diam ins. | Mean Residual Volume ccs. |
|--|-----|----------------------------------|-------------------------------|----------------------------------|-------------------------------|-------------------------|-----|----------------------|-------------------------------|----------------------|-------------------------------|------------------------------|------------------------------------|
| Plate Nos. | | 57,56,55 54,53,52 51,50,47 | | 57,56,55 54,53,52 51,50,47 | | | | | | | | | |
| Depth of Penetration | | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Depth of Penetration | | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | | |
| ins. | mm. | | | | | ins. | mm. | | | | | | |
| Crater | | | 594 | | 568 | 27 | 685 | 0.8 | 2 | 0.8 | 9 | | |
| 0 | 0 | 3.1 | 562 | 2.7 | 543 | 28 | 711 | | 0 | 0.6 | 0 | | |
| 1 | 25 | 2.5 | 481 | 2.2 | 480 | | | | | | | | |
| 2 | 51 | 1.9 | 425 | 2.0 | 425 | | | | | | | | |
| 3 | 76 | 1.8 | 369 | 1.8 | 372 | | | | | | | | |
| 4 | 102 | 1.8 | 327 | 1.8 | 324 | | | | | | | | |
| 5 | 127 | 1.5 | 294 | 1.5 | 288 | | | | | | | | |
| 6 | 152 | 1.4 | 263 | 1.4 | 258 | | | | | | | | |
| 7 | 178 | 1.3 | 239 | 1.3 | 236 | | | | | | | | |
| 8 | 203 | 1.3 | 221 | 1.3 | 215 | | | | | | | | |
| 9 | 228 | 1.4 | 201 | 1.3 | 194 | | | | | | | | |
| 10 | 254 | 1.4 | 174 | 1.4 | 169 | | | | | | | | |
| 11 | 279 | 1.4 | 146 | 1.3 | 144 | | | | | | | | |
| 12 | 304 | 1.0 | 131 | 1.0 | 130 | | | | | | | | |
| 13 | 330 | 1.0 | 119 | 0.9 | 119 | | | | | | | | |
| 14 | 355 | 0.9 | 110 | 0.9 | 109 | | | | | | | | |
| 15 | 381 | 0.9 | 103 | 0.9 | 99 | | | | | | | | |
| 16 | 406 | 0.8 | 94 | 0.7 | 90 | | | | | | | | |
| 17 | 431 | 0.9 | 79 | 0.9 | 79 | | | | | | | | |
| 18 | 456 | 0.7 | 69 | 0.9 | 70 | | | | | | | | |
| 19 | 482 | 0.8 | 62 | 0.7 | 65 | | | | | | | | |
| 20 | 508 | 0.8 | 52 | 0.8 | 55 | | | | | | | | |
| 21 | 533 | 0.6 | 46 | 0.7 | 48 | | | | | | | | |
| 22 | 558 | 0.8 | 36 | 0.7 | 40 | | | | | | | | |
| 23 | 583 | 0.7 | 32 | 0.5 | 37 | | | | | | | | |
| 24 | 609 | 0.7 | 26 | 0.5 | 32 | | | | | | | | |
| 25 | 634 | 0.6 | 19 | 0.6 | 25 | | | | | | | | |
| 26 | 660 | 0.6 | 12 | 0.5 | 21 | | | | | | | | |
| Total Depth of Penetration Inches | | 27.3 | | 28.0 | | | | | | | | Mean Total Depth ins. | |
| | | | | | | | | | | | | Standard Deviation | |
| Total Volume ccs. | | 594 | | 568 | | | | | | | | Mean Volumes ccs | |
| | | | | | | | | | | | | Standard Deviation | |

FILLING

RDX/TNT 60/40

LINER

Material: Copper
 Cone Angle: 45°
 Wall thickness: 0.280 inches

TARGET

R.H. ARI'OUR

| Round No. | | P53 | | P54 | | P85 | | P86 | | P108 | | Mean Hole Diam. ins. | Mean Residual Volume ccs. |
|-----------------------------------|------|--------------------------|--------------------|-----------------------------|--------------------|--------------------------|--------------------|--------------------------|--------------------|------------------------------|--------------------|----------------------------|---------------------------|
| Plate Nos. | | 24,25 26,27, 28,29 | | 24,25 26,27, 28,29,39 | | 24,25 26,27, 28,29 | | 24,25 26,27, 28,29 | | 33,46, 23,31, 30,29,28 | | | |
| Depth of Penetration | | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mms. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Crater: | | | 377 | | 395 | | 400 | | 425 | | 381 | | 396 |
| 0 | 0 | 2.4 | 355 | 2.3 | 378 | 2.5 | 380 | 2.5 | 393 | 2.7 | 365 | 2.5 | 374 |
| 1 | 25 | 1.9 | 306 | 1.8 | 323 | 1.7 | 325 | 1.8 | 342 | 1.8 | 306 | 1.8 | 320 |
| 2 | 51 | 1.6 | 271 | 1.5 | 289 | 1.6 | 290 | 1.6 | 310 | 1.5 | 271 | 1.6 | 286 |
| 3 | 76 | 1.4 | 242 | 1.5 | 264 | 1.5 | 262 | 1.5 | 279 | 1.5 | 236 | 1.5 | 257 |
| 4 | 102 | 1.5 | 217 | 1.5 | 235 | 1.5 | 232 | 1.5 | 254 | 1.5 | 206 | 1.5 | 229 |
| 5 | 127 | 1.4 | 188 | 1.4 | 204 | 1.5 | 202 | 1.5 | 224 | 1.4 | 190 | 1.4 | 202 |
| 6 | 152 | 1.3 | 167 | 1.3 | 183 | 1.3 | 171 | 1.4 | 199 | 1.3 | 161 | 1.3 | 176 |
| 7 | 178 | 1.0 | 153 | 1.1 | 164 | 1.1 | 147 | 1.1 | 179 | 1.1 | 142 | 1.1 | 157 |
| 8 | 203 | 1.0 | 139 | 1.1 | 152 | 1.0 | 137 | 1.0 | 164 | 1.0 | 127 | 1.0 | 144 |
| 9 | 228 | 1.0 | 128 | 1.0 | 138 | 1.0 | 123 | 1.0 | 149 | 1.0 | 116 | 1.0 | 131 |
| 10 | 254 | 1.0 | 113 | 1.0 | 124 | 1.0 | 108 | 1.0 | 133 | 0.9 | 103 | 1.0 | 116 |
| 11 | 279 | 1.1 | 103 | 1.1 | 113 | 1.0 | 98 | 1.0 | 121 | 0.9 | 89 | 1.0 | 105 |
| 12 | 304 | 1.0 | 89 | 1.0 | 94 | 1.2 | 77 | 1.1 | 104 | 0.9 | 77 | 1.0 | 88 |
| 13 | 330 | 0.8 | 79 | 0.8 | 86 | 0.9 | 66 | 0.9 | 94 | 0.8 | 68 | 0.8 | 79 |
| 14 | 355 | 0.8 | 70 | 0.8 | 77 | 0.9 | 57 | 0.8 | 84 | 0.7 | 61 | 0.8 | 70 |
| 15 | 381 | 0.7 | 61 | 0.7 | 64 | 0.7 | 46 | 0.7 | 68 | 0.6 | 48 | 0.7 | 57 |
| 16 | 406 | 0.7 | 55 | 0.8 | 55 | 0.7 | 40 | 0.7 | 59 | 0.7 | 42 | 0.7 | 50 |
| 17 | 431 | 0.7 | 48 | 0.7 | 46 | 0.6 | 31 | 0.6 | 49 | 0.6 | 35 | 0.6 | 42 |
| 18 | 456 | 0.6 | 41 | 0.6 | 42 | 0.6 | 26 | 0.6 | 42 | 0.7 | 32 | 0.6 | 37 |
| 19 | 482 | 0.6 | 37 | 0.5 | 36 | 0.6 | 21 | 0.6 | 37 | 0.6 | 24 | 0.6 | 31 |
| 20 | 508 | 0.8 | 28 | 0.7 | 30 | 0.7 | 16 | 0.7 | 25 | 0.6 | 19 | 0.7 | 24 |
| 21 | 533 | 1.1 | 16 | 0.7 | 22 | 1.0 | 5 | 1.0 | 15 | 0.7 | 13 | 0.9 | 14 |
| 22 | 558 | | 0 | 0.8 | 12 | | 0 | | 0 | 0.7 | 5 | | |
| 23 | 583 | | | 0.6 | 5 | | | | | | 0 | | |
| 24 | 609 | | | | 0 | | | | | | | | |
| Total Depth of Penetration Inches | | 21.6 | | 23.6 | | 21.6 | | 21.6 | | 22.3 | | Mean Total Depth ins. 22.1 | |
| | | | | | | | | | | | | Standard Deviation 0.87 | |
| Total Volume ccs. | | 377 | | 395 | | 400 | | 425 | | 381 | | Mean Volume ccs. 396 | |
| | | | | | | | | | | | | Standard Deviation 19 | |

FILLINGLINERTARGET

RDX/TNT 60/40

Material: Copper

R.H. ARMOUR

Cone Angle: 75°

Wall thickness: 0.088 inches

| Round No. | | P160 | | P161 | | P162 | | | | | | Mean Hole Diam. ins. | Mean Residual Volume ccs. |
|--|-----|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 46,58 59 | | 46,58 59 | | 46,58 59 | | | | | | | |
| Depth of Penetration | | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mm. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Craters: | | | 657 | | 654 | | 669 | | | | | | 660 |
| 0 | 0 | 3.5 | 593 | 3.1 | 604 | 3.1 | 613 | | | | | 3.2 | 603 |
| 1 | 25 | 2.8 | 476 | 2.6 | 504 | 2.2 | 533 | | | | | 2.5 | 504 |
| 2 | 51 | 2.2 | 404 | 2.1 | 433 | 2.0 | 470 | | | | | 2.1 | 436 |
| 3 | 76 | 2.2 | 344 | 2.1 | 371 | 2.2 | 412 | | | | | 2.2 | 376 |
| 4 | 102 | 2.2 | 284 | 2.2 | 314 | 2.2 | 349 | | | | | 2.2 | 316 |
| 5 | 127 | 2.0 | 223 | 2.0 | 248 | 2.1 | 282 | | | | | 2.0 | 251 |
| 6 | 152 | 1.7 | 179 | 1.8 | 203 | 1.9 | 233 | | | | | 1.8 | 205 |
| 7 | 178 | 1.5 | 142 | 1.5 | 164 | 1.6 | 188 | | | | | 1.5 | 165 |
| 8 | 203 | 1.4 | 116 | 1.4 | 139 | 1.4 | 158 | | | | | 1.4 | 138 |
| 9 | 228 | 1.4 | 88 | 1.3 | 114 | 1.4 | 134 | | | | | 1.4 | 112 |
| 10 | 254 | 1.4 | 60 | 1.4 | 91 | 1.4 | 111 | | | | | 1.4 | 87 |
| 11 | 279 | 1.3 | 33 | 1.5 | 63 | 1.6 | 81 | | | | | 1.5 | 59 |
| 12 | 304 | 1.0 | 12 | 1.4 | 38 | 1.6 | 44 | | | | | 1.3 | 31 |
| 13 | 330 | 0.8 | 3 | 1.0 | 16 | 1.1 | 18 | | | | | 1.0 | 12 |
| 14 | 355 | 0.7 | 0 | 0.8 | 7 | 0.8 | 8 | | | | | 0.8 | 5 |
| 15 | 381 | | | 0.5 | 0 | 0.5 | 0 | | | | | | |
| Total Depth of Penetration Inches | | 13.3 | | 14.9 | | 14.9 | | | | | | Mean Total Depth ins. 14.4 | |
| | | | | | | | | | | | | Standard - Deviation | |
| Total Volume ccs. | | 657 | | 654 | | 669 | | | | | | Mean Volume ccs. 660 | |
| | | | | | | | | | | | | Standard - Deviation | |

SECRET DISCREET

Appendix A Table 5

FILLINGLINERTARGET

RDX/TNT 60/40

Material: Copper
 Cone Angle: 75°
 Wall thickness: 0.140 inches

R.H. ARMOUR

| Round No. | | P22 | | P23 | | P24 | | P25 | | P109 | | Mean Hole Diam. ins. | Mean Residual Volume ccs. |
|--|------|----------------------|-----------------------|----------------|-----------------------|----------------|-----------------------|----------------------|-----------------------|----------------------|-----------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 19,20 21,22 23 | | 19,20 21,22 | | 19,20 21,22 | | 19,20 21,22 23 | | 33,46 23,31 30 | | | |
| Depth of Penetration | | Hole Diam. | Resi- dual Vol. | Hole Diam. | Resi- dual Vol. | Hole Diam. | Resi- dual Vol. | Hole Diam. | Resi- dual Vol. | Hole Diam. | Resi- dual Vol. | | |
| Ins. | mms. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Crater: | | | 523 | | 548 | | 558 | | 554 | | 580 | | 553 |
| 0 | 0 | 3.0 | 503 | 3.2 | 515 | 3.1 | 528 | 3.0 | 528 | 2.9 | 541 | 3.0 | 523 |
| 1 | 25 | 2.7 | 393 | 2.9 | 400 | 2.9 | 411 | 2.6 | 418 | 2.2 | 451 | 2.7 | 415 |
| 2 | 51 | 2.1 | 333 | 2.3 | 320 | 2.3 | 334 | 2.0 | 368 | 1.9 | 391 | 2.1 | 349 |
| 3 | 76 | 1.9 | 278 | 1.9 | 273 | 1.9 | 284 | 1.9 | 319 | 2.0 | 340 | 1.9 | 299 |
| 4 | 102 | 1.7 | 239 | 1.8 | 233 | 1.8 | 240 | 1.8 | 268 | 1.9 | 287 | 1.8 | 253 |
| 5 | 127 | 1.5 | 208 | 1.6 | 197 | 1.6 | 205 | 1.6 | 232 | 1.7 | 250 | 1.6 | 218 |
| 6 | 152 | 1.5 | 178 | 1.5 | 163 | 1.6 | 173 | 1.6 | 198 | 1.6 | 210 | 1.6 | 184 |
| 7 | 178 | 1.3 | 151 | 1.3 | 138 | 1.3 | 148 | 1.3 | 168 | 1.3 | 181 | 1.3 | 157 |
| 8 | 203 | 1.2 | 138 | 1.3 | 121 | 1.2 | 129 | 1.3 | 148 | 1.3 | 155 | 1.3 | 138 |
| 9 | 228 | 1.2 | 118 | 1.2 | 102 | 1.2 | 108 | 1.2 | 130 | 1.2 | 135 | 1.2 | 119 |
| 10 | 254 | 1.2 | 103 | 1.2 | 83 | 1.2 | 85 | 1.2 | 109 | 1.3 | 115 | 1.2 | 99 |
| 11 | 279 | 1.2 | 88 | 1.1 | 63 | 1.1 | 74 | 1.1 | 89 | 1.2 | 95 | 1.1 | 82 |
| 12 | 304 | 1.3 | 63 | 1.2 | 47 | 1.2 | 63 | 1.3 | 68 | 1.3 | 75 | 1.3 | 63 |
| 13 | 330 | 0.8 | 53 | 0.9 | 37 | 1.0 | 53 | 1.0 | 58 | 1.0 | 60 | 0.9 | 52 |
| 14 | 355 | 0.9 | 43 | 1.1 | 25 | 1.0 | 38 | 0.9 | 45 | 0.9 | 49 | 1.0 | 40 |
| 15 | 381 | 0.9 | 23 | 1.1 | 7 | 0.9 | 22 | 1.1 | 20 | 0.9 | 31 | 1.0 | 21 |
| 16 | 406 | 0.8 | 7 | 0.8 | 0 | 1.2 | 8 | 1.0 | 9 | 0.7 | 24 | 0.9 | 10 |
| 17 | 431 | 0.9 | 0 | | | | 0 | | 0 | 0.9 | 6 | | |
| 18 | 456 | | | | | | | | | | 0 | | |
| Total Depth of Penetration Inches | | 17.0 | | 16.4 | | 16.6 | | 16.8 | | 17.8 | | Mean Total Depth ins. 16.9 | |
| | | | | | | | | | | | | Standard Deviation 0.54 | |
| Total Volume ccs. | | 523 | | 548 | | 558 | | 554 | | 580 | | Mean Volume ccs. 553 | |
| | | | | | | | | | | | | Standard Deviation 20.5 | |

SECRET DISCREET

Appendix A Table 5A

PENETRATINGLINERTARGET

P.E. 2

Material:

Copper

R.H. ARMOUR

Cone Angle:

75°

Wall thickness:

0.140 inches

| Round No. | | P33 | | P34 | | P105 | | P106 | | P110 | | Mean Hole Diam. ins. | Mean Residual Volume ccs. |
|--|-----|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 19,20 21,22 23 | | 19,20 21,22 23 | | 24,25 26,27 28 | | 24,25 26,27 28 | | 33,46 23,31 30 | | | |
| Depth of Penetration | | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | | |
| Ins. | mm. | | | | | | | | | | | | |
| Crater: | | | 474 | | 442 | | 504 | | 469 | | 497 | | 477 |
| 0 | 0 | 2.7 | 450 | 2.5 | 417 | 2.8 | 459 | 2.5 | 440 | 2.6 | 468 | 2.6 | 447 |
| 1 | 25 | 2.1 | 383 | 1.8 | 362 | 2.2 | 389 | 1.9 | 384 | 1.9 | 397 | 2.0 | 383 |
| 2 | 51 | 1.8 | 334 | 1.7 | 324 | 1.9 | 349 | 1.7 | 344 | 1.7 | 350 | 1.8 | 340 |
| 3 | 76 | 1.6 | 302 | 1.5 | 293 | 1.7 | 309 | 1.6 | 305 | 1.7 | 309 | 1.6 | 304 |
| 4 | 102 | 1.6 | 270 | 1.6 | 266 | 1.6 | 279 | 1.6 | 278 | 1.7 | 269 | 1.6 | 272 |
| 5 | 127 | 1.6 | 233 | 1.6 | 227 | 1.7 | 240 | 1.7 | 241 | 1.5 | 237 | 1.6 | 236 |
| 6 | 152 | 1.5 | 194 | 1.4 | 198 | 1.8 | 189 | 1.8 | 189 | 1.5 | 199 | 1.6 | 194 |
| 7 | 178 | 1.2 | 165 | 1.2 | 166 | 1.3 | 159 | 1.3 | 162 | 1.2 | 155 | 1.2 | 161 |
| 8 | 203 | 1.1 | 153 | 1.1 | 148 | 1.2 | 140 | 1.2 | 144 | 1.1 | 137 | 1.1 | 144 |
| 9 | 228 | 1.1 | 134 | 1.1 | 137 | 1.1 | 122 | 1.2 | 127 | 1.1 | 123 | 1.1 | 129 |
| 10 | 254 | 1.0 | 119 | 1.0 | 122 | 1.2 | 109 | 1.1 | 111 | 1.1 | 108 | 1.1 | 114 |
| 11 | 279 | 1.2 | 109 | 1.1 | 112 | 1.2 | 89 | 1.2 | 92 | 1.1 | 90 | 1.2 | 98 |
| 12 | 304 | 1.2 | 84 | 1.3 | 87 | 1.3 | 71 | 1.3 | 71 | 1.2 | 73 | 1.3 | 77 |
| 13 | 330 | 1.1 | 69 | 1.1 | 72 | 1.1 | 54 | 1.0 | 54 | 0.9 | 51 | 1.0 | 60 |
| 14 | 355 | 1.1 | 54 | 1.1 | 57 | 0.9 | 46 | 0.8 | 44 | 1.0 | 38 | 1.0 | 48 |
| 15 | 381 | 0.8 | 39 | 1.0 | 35 | 0.8 | 28 | 0.9 | 29 | 0.7 | 23 | 0.8 | 31 |
| 16 | 406 | 0.9 | 26 | 0.8 | 23 | 1.0 | 19 | 0.9 | 18 | 0.9 | 16 | 0.9 | 20 |
| 17 | 431 | 0.8 | 6 | 1.1 | 10 | 0.6 | 0 | 0.8 | 4 | 0.7 | 5 | 0.8 | 5 |
| 18 | 456 | | 0 | | 0 | | | | 0 | | 0 | | |
| Total Depth of Penetration Inches | | 17.6 | | 17.8 | | 17.1 | | 17.3 | | 17.8 | | Mean Total Depth ins. 17.5 | |
| | | | | | | | | | | | | Standard Deviation 0.31 | |
| Total Volume ccs. | | 474 | | 442 | | 504 | | 469 | | 497 | | Mean Volume ccs. 477 | |
| | | | | | | | | | | | | Standard Deviation 25 | |

Appendix A Table 6

FILLING
RDX/TNT 60/40

LINER
Material: Copper
Cone Angle: 75°
Wall thickness: 0.280 inches

TARGET
R.H. ARMOUR

| Round No. | | P26 | | P27 | | P28 | | P87 | | P88 | | Mean Hole Diam ins. | Mean Residual Volume ccs. |
|--|-----|----------------|-----------------------|----------------|-----------------------|----------------|-----------------------|----------------|-----------------------|----------------|-----------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 19,20 21,22 | | 19,20 21,22 | | 19,20 21,22 | | 24,25 26,27 | | 24,25 26,27 | | | |
| Depth of Penetration | | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mm. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Crater | | | 373 | | 384 | | 357 | | 403 | | 372 | | 378 |
| 0 | 0 | 2.8 | 346 | 2.7 | 355 | 2.8 | 341 | 2.6 | 361 | 2.8 | 346 | 2.7 | 350 |
| 1 | 25 | 2.3 | 271 | 2.2 | 269 | 2.2 | 261 | 1.8 | 289 | 2.1 | 266 | 2.1 | 271 |
| 2 | 51 | 1.6 | 231 | 1.7 | 229 | 1.4 | 228 | 1.5 | 258 | 1.5 | 234 | 1.5 | 236 |
| 3 | 76 | 1.5 | 204 | 1.4 | 202 | 1.4 | 205 | 1.4 | 233 | 1.4 | 204 | 1.4 | 210 |
| 4 | 102 | 1.4 | 181 | 1.3 | 174 | 1.3 | 181 | 1.4 | 207 | 1.3 | 177 | 1.3 | 184 |
| 5 | 127 | 1.3 | 166 | 1.3 | 154 | 1.3 | 160 | 1.3 | 183 | 1.3 | 154 | 1.3 | 163 |
| 6 | 152 | 1.2 | 141 | 1.2 | 134 | 1.2 | 136 | 1.3 | 163 | 1.3 | 134 | 1.2 | 142 |
| 7 | 178 | 1.0 | 127 | 1.1 | 115 | 1.0 | 120 | 1.1 | 143 | 1.1 | 116 | 1.1 | 124 |
| 8 | 203 | 1.0 | 114 | 1.0 | 103 | 1.0 | 108 | 1.1 | 126 | 1.1 | 102 | 1.0 | 111 |
| 9 | 228 | 1.0 | 104 | 1.0 | 88 | 1.0 | 97 | 1.0 | 112 | 1.0 | 86 | 1.0 | 97 |
| 10 | 254 | 1.0 | 91 | 1.0 | 75 | 1.0 | 84 | 1.1 | 102 | 1.0 | 74 | 1.0 | 85 |
| 11 | 279 | 1.0 | 80 | 1.1 | 63 | 0.9 | 69 | 1.0 | 92 | 1.0 | 59 | 1.0 | 73 |
| 12 | 304 | 1.0 | 62 | 1.1 | 45 | 1.0 | 57 | 1.1 | 72 | 1.1 | 45 | 1.1 | 56 |
| 13 | 330 | 0.9 | 47 | 0.9 | 28 | 0.9 | 37 | 0.9 | 61 | 1.0 | 29 | 0.9 | 40 |
| 14 | 355 | 1.6 | 32 | 1.2 | 15 | 1.1 | 22 | 1.0 | 49 | 1.2 | 10 | 1.2 | 26 |
| 15 | 381 | | 0 | | 0 | | 0 | 1.3 | 11 | | 0 | | |
| 16 | 406 | | | | | | | | 0 | | | | |
| Total Depth of Penetration Inches | | 14.8 | | 14.8 | | 14.9 | | 15.5 | | 14.7 | | Mean Total Depth ins. 14.9 | |
| | | | | | | | | | | | | Standard Deviation 0.32 | |
| Total Volume ccs. | | 373 | | 384 | | 357 | | 403 | | 372 | | Mean Volume ccs. 378 | |
| | | | | | | | | | | | | Standard Deviation 17 | |

SECRET DISCREET

Appendix A Table 7

FILLINGLINERTARGET

RDX/TNT 60/40

Material: Copper

R.H. ARMOUR

Cone Angle: 100°

Wall thickness : 0.140 inches

| Round No. | | P29 | | P30 | | P31 | | P32 | | P111 | | Mean Hole Diam. ins. | Mean Residual Volume ccs. |
|--|-----|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 19,20 | | 19,20 | | 19,20 | | 19,20 | | 33,46 | | | |
| Depth of Penetration | | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | | |
| Ins. | mm. | | | | | | | | | | | | |
| Crater: | | | 584 | | 598 | | 583 | | 630 | | 600 | | 599 |
| 0 | 0 | 3.4 | 544 | 3.2 | 579 | 3.2 | 532 | 3.4 | 569 | 3.1 | 537 | 3.3 | 552 |
| 1 | 25 | 2.6 | 421 | 2.5 | 439 | 2.8 | 428 | 2.7 | 440 | 2.6 | 443 | 2.6 | 434 |
| 2 | 51 | 2.1 | 364 | 2.1 | 367 | 2.1 | 353 | 2.0 | 385 | 2.3 | 365 | 2.1 | 367 |
| 3 | 76 | 2.0 | 312 | 2.1 | 307 | 2.2 | 293 | 2.0 | 330 | 2.2 | 299 | 2.1 | 308 |
| 4 | 102 | 2.0 | 254 | 2.0 | 254 | 2.1 | 238 | 2.1 | 278 | 2.1 | 238 | 2.1 | 252 |
| 5 | 127 | 1.8 | 204 | 2.0 | 204 | 2.0 | 180 | 2.0 | 216 | 2.0 | 189 | 2.0 | 199 |
| 6 | 152 | 1.9 | 159 | 2.0 | 139 | 2.0 | 133 | 2.0 | 160 | 2.0 | 125 | 2.0 | 143 |
| 7 | 178 | 1.7 | 115 | 1.7 | 85 | 1.7 | 83 | 1.7 | 103 | 1.7 | 86 | 1.7 | 94 |
| 8 | 203 | 1.8 | 72 | 1.4 | 52 | 1.6 | 50 | 1.6 | 63 | 1.6 | 46 | 1.6 | 57 |
| 9 | 228 | 1.2 | 41 | 1.3 | 31 | 1.3 | 27 | 1.4 | 42 | 1.2 | 20 | 1.3 | 32 |
| 10 | 254 | 1.1 | 26 | 1.1 | 10 | 1.2 | 7 | 1.3 | 18 | 1.0 | 2 | 1.1 | 13 |
| 11 | 279 | | 11 | | 0 | | 0 | | 0 | | 0 | | |
| 12 | 304 | | 0 | | | | | | | | | | |
| Total Depth of Penetration Inches | | 11.7 | | 10.7 | | 10.6 | | 10.7 | | 10.4 | | Mean Total Depth ins. 10.8 | |
| | | | | | | | | | | | | Standard Deviation 0.51 | |
| Total Volume ccs. | | 584 | | 598 | | 583 | | 630 | | 600 | | Mean Volume ccs. 599 | |
| | | | | | | | | | | | | Standard Deviation 19 | |

SECRET DISCREET

Appendix A Table 8

FILLING
RDX/TNT 60/40

LINER
Material: Copper
Cone Angle: 100°
Wall thickness: 0.280 inches

TARGET
R.H. ARMOUR

| Round No. | | P35 | | P36 | | P37 | | P38 | | P120 | | Mean Hole Diam. ins. | Mean Residual Volume ccs. |
|--|------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|-------------------------------|------------------------------------|
| Plate Nos. | | 19,20 21 | | 19,20 21 | | 19,20 21 | | 19,20 21 | | 33,46 23 | | | |
| Depth of Penetration | | Hole | Resi- dual | Hole | Resi- dual | Hole | Resi- dual | Hole | Resi- dual | Hole | Resi- dual | | |
| Ins. | mms. | Diam ins. | Vol. ccs. | Diam ins. | Vol. ccs. | Diam ins. | Vol. ccs. | Diam ins. | Vol. ccs. | Diam ins. | Vol. ccs. | | |
| Crater: | | | 397 | | 399 | | 400 | | 395 | | 423 | | 403 |
| 0 | 0 | 2.5 | 369 | 2.5 | 370 | 2.3 | 384 | 2.6 | 373 | 1.9 | 403 | 2.4 | 380 |
| 1 | 25 | 1.6 | 322 | 1.6 | 325 | 1.7 | 338 | 1.7 | 323 | 1.8 | 357 | 1.7 | 333 |
| 2 | 51 | 1.3 | 296 | 1.3 | 299 | 1.4 | 309 | 1.3 | 296 | 1.6 | 321 | 1.4 | 304 |
| 3 | 76 | 1.4 | 272 | 1.4 | 273 | 1.4 | 286 | 1.4 | 270 | 1.5 | 288 | 1.4 | 280 |
| 4 | 102 | 1.5 | 247 | 1.4 | 246 | 1.4 | 263 | 1.4 | 242 | 1.5 | 257 | 1.4 | 251 |
| 5 | 127 | 1.4 | 219 | 1.4 | 222 | 1.4 | 236 | 1.4 | 217 | 1.5 | 228 | 1.4 | 224 |
| 6 | 152 | 1.4 | 192 | 1.5 | 187 | 1.5 | 203 | 1.5 | 187 | 1.6 | 188 | 1.5 | 191 |
| 7 | 178 | 1.3 | 160 | 1.3 | 158 | 1.4 | 175 | 1.4 | 155 | 1.4 | 155 | 1.4 | 160 |
| 8 | 203 | 1.3 | 140 | 1.3 | 134 | 1.3 | 153 | 1.3 | 134 | 1.3 | 131 | 1.3 | 138 |
| 9 | 228 | 1.3 | 119 | 1.3 | 113 | 1.3 | 131 | 1.4 | 111 | 1.3 | 113 | 1.3 | 117 |
| 10 | 254 | 1.5 | 95 | 1.7 | 79 | 1.7 | 105 | 1.5 | 76 | 1.7 | 75 | 1.6 | 86 |
| 11 | 279 | 1.6 | 66 | 1.4 | 57 | 1.2 | 73 | 1.5 | 54 | 1.6 | 52 | 1.5 | 60 |
| 12 | 304 | 1.5 | 30 | 1.5 | 17 | 1.7 | 40 | 1.5 | 16 | 1.5 | 10 | 1.5 | 23 |
| 13 | 330 | | 0 | | 0 | 0.8 | 0 | | 0 | | | | |
| Total Depth of Penetration Inches | | 12.8 | | 12.4 | | 13.1 | | 12.3 | | 12.2 | | Mean Total Depth ins. 12.5 | |
| | | | | | | | | | | | | Standard Deviation 0.38 | |
| Total Volume ccs. | | 397 | | 399 | | 400 | | 395 | | 423 | | Mean Volume ccs. 403 | |
| | | | | | | | | | | | | Standard Deviation 11.4 | |

SECRET DISCREET

Appendix A Table 9

FILLING

RDX/TNT 60/40

LINER

Material: Steel
 Cone Angle: 45°
 Wall thickness: 0.100 inches

TARGET

R.H. ARMOUR

| Round No. | P142 | | P143 | | P144 | | P145 | | P146 | | Mean Hole Diam. ins. | Mean Residual Volume ccs. |
|--|----------------|-----------------------|----------------|-----------------------|----------------|-----------------------|----------------|-----------------------|----------------------|-----------------------|-------------------------------|------------------------------------|
| Plate Nos. | 55,54 53,52 | | 55,54 53,52 | | 55,54 53,52 | | 55,54 53,52 | | 55,54 53,52 51 | | | |
| Depth of Penetration | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. mms. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Crater: | | 813 | | 763 | | 779 | | 852 | | 734 | | 788 |
| 0 0 | 3.3 | 765 | 3.6 | 710 | 3.6 | 716 | 3.3 | 782 | 3.5 | 679 | 3.5 | 730 |
| 1 25 | 3.0 | 634 | 2.8 | 578 | 3.2 | 591 | 3.3 | 651 | 2.7 | 562 | 3.0 | 603 |
| 2 51 | 2.8 | 516 | 2.4 | 490 | 2.6 | 492 | 3.1 | 524 | 2.4 | 476 | 2.65 | 500 |
| 3 76 | 2.7 | 411 | 2.4 | 416 | 2.6 | 411 | 2.5 | 431 | 2.3 | 405 | 2.5 | 415 |
| 4 102 | 2.6 | 325 | 2.4 | 334 | 2.6 | 326 | 2.3 | 352 | 2.3 | 335 | 2.4 | 334 |
| 5 127 | 2.3 | 245 | 2.4 | 254 | 2.3 | 255 | 2.3 | 280 | 2.4 | 256 | 2.35 | 258 |
| 6 152 | 1.9 | 189 | 2.0 | 195 | 1.9 | 195 | 2.0 | 224 | 2.2 | 192 | 2.0 | 199 |
| 7 178 | 1.5 | 150 | 1.7 | 150 | 1.5 | 151 | 1.5 | 176 | 1.6 | 151 | 1.55 | 156 |
| 8 203 | 1.5 | 123 | 1.4 | 119 | 1.4 | 125 | 1.3 | 152 | 1.4 | 124 | 1.4 | 129 |
| 9 228 | 1.4 | 100 | 1.4 | 95 | 1.3 | 104 | 1.3 | 126 | 1.3 | 103 | 1.35 | 106 |
| 10 254 | 1.3 | 78 | 1.4 | 76 | 1.3 | 86 | 1.2 | 106 | 1.2 | 82 | 1.3 | 86 |
| 11 279 | 1.1 | 62 | 1.4 | 55 | 1.2 | 70 | 1.2 | 87 | 1.2 | 67 | 1.2 | 68 |
| 12 304 | 1.1 | 42 | 1.2 | 32 | 1.1 | 50 | 1.1 | 66 | 1.2 | 45 | 1.15 | 47 |
| 13 330 | 1.0 | 28 | 1.1 | 15 | 1.0 | 38 | 1.1 | 50 | 1.0 | 31 | 1.05 | 32 |
| 14 355 | 0.9 | 18 | 0.6 | 6 | 1.0 | 24 | 1.1 | 35 | 0.9 | 20 | 0.9 | 21 |
| 15 381 | 0.7 | 5 | | 0 | 0.9 | 12 | 0.6 | 8 | 0.6 | 10 | | |
| 16 406 | 0.4 | 0 | | | 0.5 | 5 | 0.5 | 4 | 0.5 | 6 | | |
| 17 431 | | | | | | 0 | | 0 | 0.8 | 3 | | |
| 18 456 | | | | | | | | | | 0 | | |
| Total Depth of Penetration Inches | 16.0 | | 14.8 | | 16.8 | | 16.8 | | 17.2 | | Mean Total Depth ins. 16.3 | |
| | | | | | | | | | | | Standard Deviation 0.93 | |
| Total Volume ccs. | 813 | | 763 | | 779 | | 852 | | 734 | | Mean Volume ccs. 788 | |
| | | | | | | | | | | | Standard Deviation 45.6 | |

FILLING

RDX/TNT 60/40

LINER

Material: Steel
 Cone Angle: 45°
 Wall thickness: 0.160 inches

TARGET

R.H. ARMOUR

| Round No. | | P39 | | P92 | | P94 | | P95 | | P96 | | Mean Hole Diam. Ins. | Mean Residual Volume ccs. |
|--|-----|----------------|-----------------------|-----------------------|-----------------------|----------------|-----------------------|----------------|-----------------------|--------------|-----------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 19,20 21,22 | | 24,25 26,27 28, | | 24,25 26,27 | | 24,25 26,27 | | 24,25 26. | | | |
| Depth of Penetration | | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mm. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Craters: | | | 547 | | 559 | | 511 | | 541 | | 558 | | |
| 0 | 0 | 3.1 | 516 | 3.0 | 518 | 2.8 | 476 | 2.9 | 491 | 2.8 | 516 | 2.9 | 503 |
| 1 | 25 | 2.5 | 423 | 2.4 | 429 | 2.3 | 396 | 2.3 | 406 | 2.4 | 431 | 2.4 | 417 |
| 2 | 51 | 2.2 | 353 | 2.1 | 379 | 2.1 | 336 | 2.1 | 341 | 2.0 | 371 | 2.1 | 356 |
| 3 | 76 | 2.0 | 291 | 2.0 | 320 | 2.0 | 276 | 2.0 | 290 | 2.0 | 320 | 2.0 | 299 |
| 4 | 102 | 2.0 | 245 | 2.0 | 269 | 2.0 | 227 | 2.1 | 231 | 2.0 | 270 | 2.0 | 248 |
| 5 | 127 | 1.9 | 193 | 1.8 | 219 | 1.8 | 176 | 1.9 | 186 | 2.0 | 216 | 1.9 | 198 |
| 6 | 152 | 1.8 | 140 | 1.6 | 174 | 1.6 | 136 | 1.6 | 131 | 1.7 | 156 | 1.65 | 147 |
| 7 | 178 | 1.4 | 107 | 1.4 | 137 | 1.3 | 106 | 1.4 | 89 | 1.4 | 126 | 1.4 | 113 |
| 8 | 203 | 1.1 | 87 | 1.2 | 117 | 1.3 | 90 | 1.3 | 81 | 1.3 | 101 | 1.25 | 95 |
| 9 | 228 | 1.1 | 72 | 1.2 | 97 | 1.0 | 73 | 1.0 | 64 | 1.2 | 82 | 1.1 | 78 |
| 10 | 254 | 1.0 | 67 | 1.1 | 79 | 1.1 | 58 | 1.1 | 51 | 1.2 | 66 | 1.1 | 64 |
| 11 | 279 | 1.0 | 51 | 1.2 | 67 | 1.1 | 40 | 1.2 | 44 | 1.0 | 48 | 1.1 | 50 |
| 12 | 304 | 1.0 | 31 | 0.9 | 49 | 1.0 | 21 | 1.0 | 30 | 1.0 | 36 | 1.0 | 33 |
| 13 | 330 | 0.8 | 20 | 0.9 | 39 | 0.7 | 14 | 0.7 | 20 | 1.1 | 20 | 0.8 | 23 |
| 14 | 355 | 0.8 | 14 | 0.7 | 33 | 0.7 | 8 | 0.7 | 11 | 1.0 | 9 | 0.8 | 15 |
| 15 | 381 | | 0 | 0.7 | 22 | | 0 | | 0 | | 0 | | |
| 16 | 406 | | | 0.7 | 15 | | | | | | | | |
| 17 | 431 | | | | 0 | | | | | | | | |
| Total Depth of Penetration Inches | | 15.1 | | 16.9 | | 14.7 | | 15.0 | | 14.4 | | Mean Total Depth ins. 15.2 | |
| | | | | | | | | | | | | Standard Deviation 0.98 | |
| Total Volume ccs. | | 547 | | 559 | | 511 | | 541 | | 558 | | Mean Volume ccs. 543 | |
| | | | | | | | | | | | | Standard Deviation 19.5 | |

Appendix A Table 11

FILLING

RDX/TNT 60/40

LINER

Material: Steel
 Cone Angle: 45°
 Wall thickness: 0.320 inches

TARGET

R.H. ARMOUR

| Round No. | | P97 | | P98 | | P99 | | P100 | | P112 | | Mean Hole Diam Ins. | Mean Residual Volume ccs. |
|--|-----|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|---|------------------------------------|
| Plate Nos. | | 24,25 26. | | 24,25 | | 24,25 26 | | 24,25 26 | | 33,46 | | | |
| Depth of Penetration | | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | | |
| Ins. | mm. | | | | | | | | | | | | |
| Crater: | | | 292 | | 299 | | 313 | | 298 | | 321 | | 305 |
| 0 | 0 | 2.2 | 266 | 2.1 | 279 | 2.1 | 292 | 2.1 | 262 | 2.0 | 310 | 2.1 | 282 |
| 1 | 25 | 1.7 | 214 | 1.9 | 220 | 1.8 | 241 | 1.8 | 215 | 1.8 | 255 | 1.8 | 229 |
| 2 | 51 | 1.5 | 181 | 1.5 | 187 | 1.7 | 205 | 1.6 | 180 | 1.7 | 220 | 1.6 | 195 |
| 3 | 76 | 1.5 | 153 | 1.5 | 157 | 1.5 | 173 | 1.4 | 151 | 1.6 | 188 | 1.5 | 164 |
| 4 | 102 | 1.4 | 126 | 1.5 | 130 | 1.4 | 144 | 1.4 | 122 | 1.5 | 151 | 1.4 | 135 |
| 5 | 127 | 1.3 | 101 | 1.4 | 100 | 1.5 | 117 | 1.4 | 96 | 1.4 | 121 | 1.4 | 107 |
| 6 | 152 | 1.3 | 76 | 1.3 | 71 | 1.4 | 90 | 1.4 | 70 | 1.2 | 95 | 1.3 | 80 |
| 7 | 178 | 1.1 | 59 | 1.1 | 50 | 1.0 | 66 | 1.1 | 51 | 1.0 | 65 | 1.1 | 58 |
| 8 | 203 | 0.9 | 43 | 0.8 | 40 | 0.8 | 54 | 1.0 | 39 | 0.9 | 55 | 0.9 | 46 |
| 9 | 228 | 0.7 | 39 | 0.8 | 30 | 0.8 | 44 | 0.8 | 30 | 0.9 | 45 | 0.8 | 38 |
| 10 | 254 | 0.8 | 31 | 0.8 | 22 | 0.9 | 34 | 0.7 | 20 | 0.9 | 32 | 0.8 | 28 |
| 11 | 279 | 0.8 | 24 | 0.8 | 15 | 0.8 | 26 | 0.7 | 14 | 1.0 | 29 | 0.8 | 22 |
| 12 | 304 | 1.0 | 11 | 1.6 | 0 | 0.9 | 14 | 1.0 | 1 | 1.0 | 0 | 1.1 | 5 |
| 13 | 330 | | 0 | | | | 0 | | 0 | | | | |
| Total Depth of Penetration Inches | | 12.5 | | 12.0 | | 12.8 | | 12.1 | | 12.0 | | Mean Total Depth ins. 12.3 Standard Deviation 0.36 | |
| Total Volume ccs. | | 292 | | 299 | | 313 | | 298 | | 321 | | Mean Volume ccs. 305 Standard Deviation 12 | |

FILLING
RDX/TNT 60/40

LINER
Material: Steel
Cone Angles: 75°
Wall thickness: 0.100 inches

TARGET
R.H. ARMOUR

| Round No. | | P 147 | | P 148 | | P 149 | | P 150 | | P 151 | | Mean Hole Diam Ins. | Mean Residual Volume ccs. |
|--|-----|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 55,54 53 | | 55,54 53 | | 55,54 53 | | 55,54 53 | | 55,54 53 | | | |
| Depth of Penetration | | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | | |
| Ins. | mm. | | | | | | | | | | | | |
| Crater: | | | 695 | | 701 | | 610 | | 684 | | 689 | | 676 |
| 0 | 0 | 3.4 | 654 | 3.5 | 656 | 3.0 | 565 | 3.2 | 614 | 3.4 | 639 | 3.3 | 626 |
| 1 | 25 | 2.3 | 555 | 2.6 | 546 | 2.2 | 492 | 2.5 | 524 | 2.3 | 548 | 2.4 | 533 |
| 2 | 51 | 1.9 | 493 | 2.4 | 469 | 1.9 | 444 | 2.4 | 441 | 2.2 | 480 | 2.15 | 465 |
| 3 | 76 | 2.3 | 428 | 2.5 | 386 | 1.9 | 393 | 2.3 | 367 | 2.3 | 416 | 2.25 | 398 |
| 4 | 102 | 2.5 | 352 | 2.4 | 309 | 2.1 | 346 | 2.4 | 295 | 2.4 | 341 | 2.35 | 329 |
| 5 | 127 | 2.4 | 268 | 2.3 | 239 | 2.1 | 291 | 2.3 | 228 | 2.4 | 264 | 2.3 | 258 |
| 6 | 152 | 2.0 | 205 | 2.0 | 176 | 2.1 | 230 | 2.0 | 168 | 2.2 | 190 | 2.05 | 194 |
| 7 | 178 | 1.8 | 150 | 1.9 | 117 | 1.9 | 176 | 1.9 | 112 | 1.9 | 138 | 1.9 | 139 |
| 8 | 203 | 1.6 | 113 | 1.6 | 77 | 1.8 | 137 | 1.5 | 77 | 1.7 | 93 | 1.65 | 100 |
| 9 | 228 | 1.6 | 80 | 1.4 | 51 | 1.9 | 97 | 1.4 | 47 | 1.5 | 63 | 1.55 | 68 |
| 10 | 254 | 1.3 | 58 | 1.0 | 33 | 1.5 | 63 | 1.2 | 28 | 1.2 | 41 | 1.25 | 45 |
| 11 | 279 | 1.2 | 38 | 1.0 | 20 | 1.4 | 39 | 0.9 | 14 | 1.2 | 23 | 1.15 | 27 |
| 12 | 304 | 1.2 | 20 | 1.0 | 4 | 1.6 | 9 | 1.2 | 2 | 1.3 | 5 | 1.25 | 8 |
| 13 | 330 | 0.8 | 4 | | 0 | | 0 | | 0 | | 0 | | |
| 14 | 355 | | 0 | | | | | | | | | | |
| Total Depth of Penetration Inches | | 13.4 | | 12.5 | | 12.7 | | 12.2 | | 12.8 | | Mean Total Depth ins. 12.7 | |
| | | | | | | | | | | | | Standard Deviation 0.45 | |
| Total Volume ccs. | | 695 | | 701 | | 610 | | 684 | | 689 | | Mean Volume ccs. 676 | |
| | | | | | | | | | | | | Standard Deviation 37.3 | |

SECRET DISCREET

Appendix A Table 13

FILLINGLINERTARGET

RDX/TNT 60/40

Material: Steel

Cone Angle : 75°

Wall thickness: 0.160 inches

R.H. ARMOUR

| Round No. | | P49 | | P121 | | P122 | | P125 | | P126 | | Mean Hole diam. ins. | Mean Residual Volume ccs. |
|--|-----|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 24,25 26. | | 55,54 53. | | 55,54 53. | | 55,54 53. | | 55,54 53. | | | |
| Depth of Penetration | | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mm. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Crater: | | | 510 | | 478 | | 500 | | 540 | | 571 | | 520 |
| 0 | 0 | 2.9 | 454 | 2.8 | 440 | 2.8 | 463 | 2.8 | 476 | 3.3 | 513 | 2.9 | 469 |
| 1 | 25 | 2.4 | 363 | 2.2 | 375 | 2.3 | 386 | 2.3 | 400 | 2.4 | 437 | 2.3 | 392 |
| 2 | 51 | 2.0 | 299 | 2.3 | 306 | 2.1 | 328 | 2.1 | 342 | 2.2 | 377 | 2.15 | 330 |
| 3 | 76 | 2.0 | 250 | 2.0 | 252 | 2.0 | 275 | 2.1 | 289 | 2.1 | 314 | 2.05 | 276 |
| 4 | 102 | 1.8 | 209 | 1.8 | 203 | 1.9 | 226 | 2.0 | 237 | 2.1 | 253 | 1.9 | 227 |
| 5 | 127 | 1.7 | 176 | 1.9 | 161 | 1.8 | 179 | 1.9 | 189 | 2.0 | 203 | 1.85 | 182 |
| 6 | 152 | 1.7 | 129 | 1.8 | 118 | 1.7 | 141 | 1.9 | 152 | 1.9 | 153 | 1.8 | 139 |
| 7 | 178 | 1.4 | 97 | 1.5 | 92 | 1.4 | 109 | 1.6 | 115 | 1.4 | 120 | 1.45 | 107 |
| 8 | 203 | 1.3 | 77 | 1.4 | 69 | 1.4 | 86 | 1.4 | 89 | 1.3 | 93 | 1.35 | 83 |
| 9 | 228 | 1.1 | 57 | 1.4 | 43 | 1.2 | 64 | 1.3 | 64 | 1.2 | 73 | 1.25 | 61 |
| 10 | 254 | 1.2 | 39 | 1.2 | 27 | 1.1 | 46 | 1.2 | 43 | 1.5 | 53 | 1.25 | 42 |
| 11 | 279 | 1.0 | 22 | 1.1 | 14 | 1.1 | 26 | 1.3 | 26 | 1.3 | 27 | 1.15 | 23 |
| 12 | 304 | 1.2 | 2 | 0.6 | 0 | 1.2 | 9 | 1.4 | 6 | 1.2 | 5 | 1.1 | 5 |
| 13 | 330 | | 0 | | | | 0 | | 0 | | 0 | | |
| Total Depth of Penetration Inches | | 12.1 | | 12.1 | | 12.3 | | 12.7 | | 12.3 | | Mean Total Depth ins. 12.3 | |
| | | | | | | | | | | | | Standard Deviation 0.24 | |
| Total Volume ccs. | | 510 | | 478 | | 500 | | 540 | | 571 | | Mean Volume ccs. 520 | |
| | | | | | | | | | | | | Standard Deviation 36 | |

Appendix A Table 14

FILLING
RDX/TNT 60/40

LINER
Material: Steel
Cone Angle: 75°
Wall thickness: 0.320 inches

TARGET
R.H. ARMOUR

| Round No. | | P101 | | P102 | | P103 | | P104 | | P113 | | Mean Hole Diam Ins. | Mean Residual Volume ccs. |
|--|------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 24,25 | | 24,25 | | 24,25 | | 24,25 | | 33,46 | | | |
| Depth of Penetration | | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mms. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Crater: | | | 314 | | 314 | | 271 | | 285 | | 292 | | 295 |
| 0 | 0 | 2.1 | 285 | 2.1 | 279 | 2.0 | 242 | 2.0 | 254 | 2.1 | 274 | 2.1 | 267 |
| 1 | 25 | 1.7 | 245 | 1.7 | 234 | 1.7 | 204 | 1.6 | 209 | 1.5 | 232 | 1.6 | 225 |
| 2 | 51 | 1.4 | 221 | 1.5 | 204 | 1.3 | 177 | 1.5 | 184 | 1.4 | 207 | 1.4 | 199 |
| 3 | 76 | 1.2 | 199 | 1.3 | 183 | 1.2 | 157 | 1.3 | 159 | 1.4 | 182 | 1.3 | 176 |
| 4 | 102 | 1.2 | 180 | 1.3 | 162 | 1.3 | 134 | 1.3 | 139 | 1.3 | 159 | 1.3 | 155 |
| 5 | 127 | 1.2 | 161 | 1.2 | 140 | 1.3 | 113 | 1.4 | 116 | 1.3 | 133 | 1.3 | 133 |
| 6 | 152 | 1.3 | 139 | 1.4 | 104 | 1.6 | 84 | 1.9 | 84 | 1.4 | 100 | 1.5 | 102 |
| 7 | 178 | 1.2 | 116 | 1.4 | 69 | 1.3 | 59 | 1.5 | 50 | 1.4 | 65 | 1.4 | 72 |
| 8 | 203 | 1.0 | 100 | 1.5 | 43 | 1.3 | 37 | 1.3 | 27 | 1.4 | 38 | 1.3 | 49 |
| 9 | 228 | 1.0 | 88 | 1.6 | 7 | 1.2 | 15 | 1.1 | 3 | 1.2 | 8 | 1.2 | 24 |
| 10 | 254 | 1.2 | 76 | | 0 | | 0 | | 0 | | 0 | | 15 |
| 11 | 279 | 1.7 | 45 | | | | | | | | | | |
| 12 | 304 | 2.0 | 0 | | | | | | | | | | |
| Total Depth of Penetration Inches | | 12.0 | | 9.7 | | 9.5 | | 9.2 | | 9.5 | | Mean Total Depth ins. 10.0 | |
| | | | | | | | | | | | | Standard Deviation 1.1 | |
| Total Volume ccs. | | 314 | | 314 | | 271 | | 285 | | 292 | | Mean Volume ccs. 295 | |
| | | | | | | | | | | | | Standard Deviation 18.8 | |

Appendix A Table 15

FILLING

RDX/TNT 60/40

LINER

Material: Steel

Cone Angle: 100°

Wall thickness : 0.100 inches

TARGET

R.H. ARMOUR

| Round No. | | P152 | | P 153 | | P 154 | | P 155 | | P156 | | Mean Hole Diam. Ins. | Mean Residual Volume ccs. |
|--|-----|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 55,54 | | 55,54 | | 55,54 | | 55,54 | | 55,54 | | | |
| Depth of Penetration | | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mm. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Crater: | | | 635 | | 677 | | 689 | | 673 | | 674 | | 670 |
| 0 | 0 | 1.9 | 617 | 2.1 | 648 | 2.2 | 652 | 2.1 | 643 | 2.0 | 648 | 2.05 | 642 |
| 1 | 25 | 1.9 | 576 | 1.9 | 600 | 1.9 | 600 | 1.9 | 592 | 1.9 | 606 | 1.9 | 595 |
| 2 | 51 | 1.8 | 530 | 2.1 | 542 | 2.2 | 541 | 2.2 | 532 | 2.3 | 548 | 2.1 | 539 |
| 3 | 76 | 2.4 | 466 | 2.4 | 477 | 2.4 | 457 | 2.4 | 455 | 2.4 | 455 | 2.4 | 464 |
| 4 | 102 | 2.6 | 379 | 2.6 | 370 | 2.6 | 365 | 2.6 | 362 | 2.7 | 354 | 2.6 | 368 |
| 5 | 127 | 2.5 | 285 | 2.6 | 272 | 2.7 | 257 | 2.7 | 269 | 2.7 | 254 | 2.65 | 269 |
| 6 | 152 | 2.5 | 195 | 2.5 | 182 | 2.4 | 165 | 2.5 | 178 | 2.7 | 159 | 2.5 | 178 |
| 7 | 178 | 2.0 | 108 | 2.0 | 92 | 1.8 | 78 | 2.0 | 83 | 1.8 | 30 | 1.9 | 88 |
| 8 | 203 | 1.7 | 66 | 1.5 | 53 | 1.5 | 46 | 1.6 | 44 | 1.4 | 50 | 1.55 | 52 |
| 9 | 228 | 1.5 | 36 | 1.2 | 31 | 1.3 | 22 | 1.3 | 25 | 1.2 | 29 | 1.3 | 29 |
| 10 | 254 | 1.2 | 18 | 1.2 | 13 | 0.9 | 7 | 1.4 | 8 | 1.2 | 13 | 1.2 | 12 |
| 11 | 279 | 1.7 | 3 | 0.6 | 0 | | 0 | | 0 | | 0 | | |
| 12 | 304 | | 0 | | | | | | | | | | |
| Total Depth of Penetration Inches | | 11.2 | | 11.0 | | 10.6 | | 10.4 | | 10.8 | | Mean Total Depth ins. 10.8 | |
| | | | | | | | | | | | | Standard Deviation 0.31 | |
| Total Volume ccs. | | 635 | | 677 | | 689 | | 673 | | 674 | | Mean Volume ccs. 670 | |
| | | | | | | | | | | | | Standard Deviation 20.4 | |

FILLING

RDX/TNT 60/40

LINER

Material: Steel
 Cone Angle: 100°
 Wall thickness: 0.160 inches

TARGET

R.H. ARMOUR

| Round No. | | P123 | | P124 | | P127 | | P128 | | P129 | | Mean Hole Diam Ins. | Mean Residual Volume ccs. |
|--|------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 55,54 | | 55,54 | | 55,54 | | 55,54 | | 55,54 | | | |
| Depth of Penetration | | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mms. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Crater: | | | 587 | | 598 | | 611 | | 626 | | 615 | | 607 |
| 0 | 0 | 2.7 | 525 | 3.1 | 557 | 2.7 | 550 | 2.6 | 550 | 3.1 | 554 | 2.8 | 547 |
| 1 | 25 | 2.7 | 426 | 2.6 | 449 | 2.3 | 466 | 2.4 | 452 | 2.2 | 460 | 2.4 | 451 |
| 2 | 51 | 2.2 | 364 | 2.1 | 389 | 2.3 | 399 | 2.2 | 392 | 2.1 | 398 | 2.2 | 388 |
| 3 | 76 | 2.1 | 306 | 2.2 | 324 | 2.4 | 329 | 2.1 | 332 | 2.1 | 338 | 2.2 | 326 |
| 4 | 102 | 2.2 | 244 | 2.3 | 260 | 2.3 | 260 | 2.2 | 267 | 2.2 | 270 | 2.15 | 260 |
| 5 | 127 | 2.1 | 176 | 2.1 | 197 | 2.1 | 195 | 2.3 | 197 | 2.2 | 202 | 2.15 | 193 |
| 6 | 152 | 2.0 | 122 | 2.0 | 140 | 2.3 | 134 | 2.1 | 141 | 2.1 | 146 | 2.1 | 137 |
| 7 | 178 | 1.8 | 77 | 1.9 | 82 | 1.7 | 76 | 1.9 | 84 | 2.0 | 85 | 1.85 | 81 |
| 8 | 203 | 1.3 | 47 | 1.6 | 51 | 1.5 | 52 | 1.5 | 47 | 1.5 | 49 | 1.5 | 49 |
| 9 | 228 | 1.4 | 19 | 1.4 | 22 | 1.2 | 27 | 1.5 | 21 | 1.4 | 23 | 1.4 | 22 |
| 10 | 254 | 1.0 | 3 | 1.0 | 5 | 1.3 | 10 | 1.0 | 0 | 1.1 | 4 | 1.1 | 4 |
| 11 | 279 | | 0 | | 0 | | 0 | | | | 0 | | |
| Total Depth of Penetration Inches | | 10.2 | | 10.3 | | 10.4 | | 10.2 | | 10.4 | | Mean Total Depth ins. 10.3 | |
| | | | | | | | | | | | | Standard Deviation 0.1 | |
| Total Volume ccs. | | 587 | | 598 | | 611 | | 626 | | 615 | | Mean Volume ccs. 607 | |
| | | | | | | | | | | | | Standard Deviation 15.4 | |

SECRET DISCREET

Appendix A Table 17

FILLING

RDX/TNT 60/40

LINER

Material: Stegl
 Cone Angle: 100
 Wall thickness: 0.320 inches

TARGET

R.H. ARMOUR

| Round No. | | P63 | | P64 | | P81 | | P82 | | P114 | | Mean Hole Diam ins. | Mean Residual Volume ccs. |
|--|-----|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|------------------------------|------------------------------------|
| Plate Nos. | | 32,33 | | 32,33 | | 32,33 | | 32,33 | | 33,46 | | | |
| Depth of Penetration | | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mm. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Crater: | | | 308 | | 320 | | 321 | | 334 | | 315 | | 320 |
| 0 | 0 | 2.1 | 288 | 2.0 | 290 | 2.0 | 304 | 1.9 | 310 | 2.0 | 294 | 2.0 | 297 |
| 1 | 25 | 1.7 | 247 | 1.6 | 249 | 1.7 | 261 | 1.8 | 262 | 1.6 | 250 | 1.7 | 254 |
| 2 | 51 | 1.5 | 215 | 1.4 | 216 | 1.5 | 232 | 1.4 | 232 | 1.4 | 220 | 1.4 | 223 |
| 3 | 76 | 1.3 | 189 | 1.3 | 195 | 1.2 | 206 | 1.3 | 210 | 1.3 | 195 | 1.3 | 199 |
| 4 | 102 | 1.4 | 166 | 1.4 | 170 | 1.3 | 187 | 1.3 | 187 | 1.4 | 172 | 1.4 | 176 |
| 5 | 127 | 1.4 | 138 | 1.4 | 145 | 1.5 | 162 | 1.6 | 158 | 1.5 | 144 | 1.5 | 149 |
| 6 | 152 | 1.6 | 104 | 1.6 | 110 | 2.0 | 110 | 1.8 | 112 | 1.4 | 105 | 1.7 | 108 |
| 7 | 178 | 1.9 | 45 | 1.8 | 65 | 1.9 | 50 | 2.1 | 40 | 1.9 | 55 | 1.9 | 52 |
| 8 | 203 | 1.3 | 7 | 1.7 | 29 | 1.7 | 0 | 1.3 | 2 | 1.5 | 16 | 1.5 | 11 |
| 9 | 228 | | 0 | | 0 | | | | 0 | | 0 | | |
| Total Depth of Penetration Inches | | 8.4 | | 9.0 | | 8.0 | | 8.2 | | 8.5 | | Mean total Depth ins. 8.4 | |
| | | | | | | | | | | | | Standard Deviation 0.38 | |
| Total Volume ccs. | | 308 | | 320 | | 321 | | 334 | | 315 | | Mean Volume ccs. 320 | |
| | | | | | | | | | | | | Standard Deviation 9.6 | |

SECRET DISCREET

Appendix A Table 18

FILLING

RDX/TNT 60/40

LINER

Material: Aluminium
 Cone Angle: 45°
 Wall thickness: 0.300 inches

TARGET

R.H. ARMOUR

| Round No. | | P 132 | | P 133 | | P 134 | | P 135 | | P 136 | | Mean Hole Diam. ins. | Mean Residual Volume ccs. |
|--|-----|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 55,54, 53 | | 55,54 | | 55,54 | | 55,54 | | 55,54, 53 | | | |
| Depth of Penetration | | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mm. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Craters: | | | 799 | | 825 | | 801 | | 832 | | 809 | | 813 |
| 0 | 0 | 4.1 | 724 | 3.9 | 754 | 3.9 | 707 | 3.8 | 760 | 4.1 | 725 | 4.0 | 734 |
| 1 | 25 | 3.5 | 564 | 3.4 | 603 | 3.2 | 572 | 3.7 | 605 | 3.1 | 590 | 3.4 | 587 |
| 2 | 51 | 3.0 | 438 | 3.0 | 472 | 3.0 | 441 | 3.3 | 460 | 2.9 | 471 | 3.05 | 456 |
| 3 | 76 | 2.5 | 350 | 2.6 | 375 | 2.7 | 350 | 2.9 | 352 | 2.6 | 377 | 2.65 | 361 |
| 4 | 102 | 2.2 | 284 | 2.6 | 287 | 2.7 | 256 | 2.6 | 258 | 2.5 | 299 | 2.5 | 277 |
| 5 | 127 | 2.2 | 214 | 2.0 | 213 | 2.0 | 191 | 2.2 | 185 | 2.5 | 223 | 2.2 | 205 |
| 6 | 152 | 2.1 | 162 | 1.9 | 163 | 1.9 | 144 | 1.9 | 136 | 2.1 | 161 | 2.0 | 153 |
| 7 | 178 | 1.5 | 120 | 1.5 | 113 | 1.4 | 99 | 1.4 | 88 | 1.5 | 121 | 1.45 | 108 |
| 8 | 203 | 1.4 | 93 | 1.5 | 86 | 1.4 | 74 | 1.4 | 64 | 1.4 | 95 | 1.4 | 82 |
| 9 | 228 | 1.3 | 69 | 1.3 | 63 | 1.2 | 55 | 1.3 | 46 | 1.4 | 73 | 1.3 | 61 |
| 10 | 254 | 1.3 | 46 | 1.3 | 42 | 1.3 | 35 | 1.4 | 27 | 1.3 | 53 | 1.3 | 41 |
| 11 | 279 | 1.3 | 26 | 1.4 | 18 | 1.2 | 13 | 1.1 | 6 | 1.3 | 31 | 1.25 | 19 |
| 12 | 304 | 1.4 | 3 | | 0 | | 0 | | 0 | 1.6 | 3 | | |
| 13 | 330 | | 0 | | | | | | | | 0 | | |
| Total Depth of Penetration Inches | | 12.2 | | 11.7 | | 11.5 | | 11.3 | | 12.2 | | Mean Total Depth ins. 11.8 | |
| | | | | | | | | | | | | Standard Deviation 0.41 | |
| Total Volume ccs. | | 799 | | 825 | | 801 | | 832 | | 809 | | Mean Volume ccs. 813 | |
| | | | | | | | | | | | | Standard Deviation 14.6 | |

SECRET DISCREET

Appendix A Table 19

FILLING

RDX/TNT 60/40

LINER

Material: Aluminium

TARGET

R.H. ARFOUR

Cone Angle: 45°

Wall thickness: 0.470 inches

| Round No. | | P55 | | P56 | | P89 | | P90 | | P115 | | Mean Hole Diam -- ins. | Mean Residual Volume ccs. |
|--|-----|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|---------------------------------|------------------------------------|
| Plate Nos. | | 24, 25 | | 24, 25 | | 24, 25 | | 24, 25 | | 33, 46 | | | |
| Depth of Penetration | | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | | |
| Ins. | mm. | | | | | | | | | | | | |
| Crater: | | | 619 | | 610 | | 599 | | 552 | | 590 | | 594 |
| 0 | 0 | 3.3 | 545 | 3.4 | 562 | 3.2 | 532 | 3.1 | 499 | 3.2 | 545 | 3.2 | 537 |
| 1 | 25 | 2.8 | 437 | 2.7 | 455 | 2.6 | 426 | 2.6 | 405 | 2.7 | 444 | 2.7 | 433 |
| 2 | 51 | 2.5 | 345 | 2.4 | 375 | 2.3 | 346 | 2.4 | 324 | 2.5 | 340 | 2.4 | 346 |
| 3 | 76 | 2.3 | 271 | 2.2 | 301 | 2.2 | 269 | 2.2 | 256 | 2.2 | 274 | 2.2 | 274 |
| 4 | 102 | 2.1 | 215 | 2.2 | 235 | 2.2 | 219 | 2.1 | 199 | 2.2 | 212 | 2.2 | 216 |
| 5 | 127 | 2.0 | 155 | 2.1 | 176 | 2.1 | 155 | 2.0 | 134 | 2.0 | 156 | 2.0 | 155 |
| 6 | 152 | 1.8 | 105 | 1.9 | 120 | 1.8 | 99 | 1.8 | 79 | 1.9 | 90 | 1.8 | 99 |
| 7 | 178 | 1.3 | 81 | 1.3 | 91 | 1.2 | 72 | 1.3 | 55 | 1.3 | 55 | 1.3 | 71 |
| 8 | 203 | 1.1 | 61 | 1.2 | 72 | 1.2 | 60 | 1.2 | 36 | 1.2 | 35 | 1.2 | 53 |
| 9 | 228 | 1.2 | 46 | 1.1 | 57 | 1.1 | 40 | 1.1 | 20 | 1.1 | 16 | 1.1 | 36 |
| 10 | 254 | 1.2 | 26 | 1.2 | 40 | 1.2 | 20 | 0.9 | 7 | 0.8 | 2 | 1.1 | 19 |
| 11 | 279 | | 0 | 1.4 | 17 | | 0 | | 0 | | 0 | | |
| 12 | 304 | | | | 0 | | | | | | | | |
| Total Depth of Penetration Inches | | 11.0 | | 11.4 | | 11.3 | | 10.6 | | 10.1 | | Mean Total Depth ins. 10.9 | |
| | | | | | | | | | | | | Standard Deviation 0.44 | |
| Total Volume ccs. | | 619 | | 610 | | 599 | | 552 | | 590 | | Mean Volume ccs. 594 | |
| | | | | | | | | | | | | Standard Deviation 26 | |

SECRET DISCREET

Appendix A Table 20

FILLING

RDX/TNT 60/40

LINER

Material: Aluminium
 Cone Angle: 45°
 Wall thickness: 0.940 inches

TARGET

R.H. ARMOUR

| Round No. | | P65 | | P66 | | P67 | | P68 | | P116 | | Mean Hole Diam ins. | Mean Residual Volume ccs. |
|--|------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|------------------------------|------------------------------------|
| Plate Nos. | | 32,33 | | 32,33 | | 32,33 | | 32,33 | | 33,46 | | | |
| Depth of Penetration | | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mms. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Crater: | | | 220 | | 226 | | 217 | | 228 | | 209 | | 220 |
| 0 | 0 | 1.5 | 205 | 1.7 | 209 | 1.9 | 204 | 1.7 | 215 | 1.8 | 198 | 1.7 | 206 |
| 1 | 25 | 1.5 | 183 | 1.3 | 183 | 1.3 | 177 | 1.5 | 182 | 1.3 | 176 | 1.4 | 180 |
| 2 | 51 | 1.6 | 143 | 1.5 | 153 | 1.5 | 145 | 1.6 | 145 | 1.6 | 138 | 1.6 | 145 |
| 3 | 76 | 1.4 | 113 | 1.4 | 125 | 1.4 | 117 | 1.5 | 116 | 1.4 | 113 | 1.4 | 117 |
| 4 | 102 | 1.3 | 91 | 1.4 | 100 | 1.3 | 96 | 1.4 | 92 | 1.4 | 86 | 1.4 | 93 |
| 5 | 127 | 1.4 | 73 | 1.4 | 78 | 1.5 | 70 | 1.5 | 70 | 1.4 | 59 | 1.4 | 70 |
| 6 | 152 | 1.4 | 35 | 1.5 | 41 | 1.4 | 35 | 1.5 | 30 | 1.3 | 33 | 1.4 | 35 |
| 7 | 178 | 1.0 | 15 | 1.1 | 21 | 1.0 | 16 | 1.0 | 14 | 1.0 | 12 | 1.0 | 16 |
| 8 | 203 | | 3 | 0.7 | 9 | 0.9 | 6 | | 4 | 0.8 | 3 | | 5 |
| 9 | 228 | | 0 | | 0 | | 0 | | 0 | | 0 | | |
| Total Depth of Penetration Inches | | 8.4 | | 8.8 | | 8.6 | | 8.4 | | 8.6 | | Mean Total Depth ins. 8.6 | |
| | | | | | | | | | | | | Standard Deviation 0.17 | |
| Total Volume ccs. | | 220 | | 226 | | 217 | | 228 | | 209 | | Mean Volume ccs. 220 | |
| | | | | | | | | | | | | Standard Deviation 7.6 | |

SECRET DISCREET

Appendix A Table 21

FILLING

RDX/TNT 60/40

LINER

Material: Aluminium
 Cone Angle: 75°
 Wall thickness: 0.300 inches

TARGET

R.H. ARMOUR

| Round No. | | P137 | | P138 | | P139 | | P140 | | P141 | | Mean Hole Diam ins. | Mean Residual Volume ccs. |
|--|-----|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|------------------------------|------------------------------------|
| Plate Nos. | | 55,54 | | 55,54 | | 55,54 | | 55,54 | | 55,54 | | | |
| Depth of Penetration | | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mm. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Crater: | | | 672 | | 672 | | 653 | | 666 | | 710 | | 675 |
| 0 | 0 | 3.5 | 607 | 3.6 | 607 | 3.4 | 602 | 3.5 | 609 | 3.4 | 646 | 3.5 | 614 |
| 1 | 25 | 3.0 | 481 | 3.0 | 481 | 3.0 | 482 | 3.0 | 494 | 2.8 | 522 | 3.0 | 492 |
| 2 | 51 | 2.6 | 388 | 2.5 | 387 | 2.3 | 401 | 2.5 | 407 | 2.7 | 423 | 2.5 | 401 |
| 3 | 76 | 2.6 | 304 | 2.5 | 311 | 2.4 | 332 | 2.3 | 336 | 2.6 | 337 | 2.5 | 324 |
| 4 | 102 | 2.5 | 223 | 2.5 | 235 | 2.4 | 265 | 2.2 | 274 | 2.7 | 244 | 2.45 | 248 |
| 5 | 127 | 2.5 | 134 | 2.5 | 153 | 2.3 | 191 | 2.4 | 199 | 2.6 | 153 | 2.45 | 166 |
| 6 | 152 | 2.2 | 61 | 2.3 | 74 | 2.3 | 119 | 2.4 | 126 | 2.5 | 76 | 2.35 | 91 |
| 7 | 178 | 1.4 | 7 | 1.5 | 10 | 1.9 | 50 | 1.9 | 60 | 1.6 | 11 | 1.65 | 28 |
| 8 | 203 | | 0 | | 0 | 1.6 | 11 | 1.8 | 16 | | 0 | | |
| 9 | 228 | | | | | | 0 | | 0 | | | | |
| Total Depth of Penetration Inches | | 7.4 | | 7.5 | | 8.6 | | 8.8 | | 7.6 | | Mean Total Depth ins. 8.0 | |
| | | | | | | | | | | | | Standard Deviation 0.66 | |
| Total Volume ccs. | | 672 | | 672 | | 653 | | 666 | | 710 | | Mean Volume ccs. 675 | |
| | | | | | | | | | | | | Standard Deviation 21.2 | |

FILLING

RDX/TNT 60/40

LINER

Material: Aluminium
 Cone Angle : 75°
 Wall thickness: 0.470 inches

TARGET

R.H. ARMOUR

| Round No. | | P59 | | P60 | | P69 | | P70 | | P117 | | Mean Hole Diam ins. | Mean Residual Volume ccs. |
|--|------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|------------------------------|------------------------------------|
| Plate Nos. | | 32,33 | | 32,33 | | 32,33 | | 32,33 | | 33,46 | | | |
| Depth of Penetration | | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | | |
| Ins. | mms. | | | | | | | | | | | | |
| Crater: | | | 507 | | 507 | | 518 | | 506 | | 447 | | 497 |
| 0 | 0 | 3.0 | 430 | 2.8 | 440 | 2.8 | 454 | 2.7 | 437 | 2.7 | 405 | 2.8 | 433 |
| 1 | 25 | 2.5 | 332 | 2.4 | 352 | 2.4 | 368 | 2.4 | 357 | 2.1 | 325 | 2.4 | 347 |
| 2 | 51 | 2.1 | 271 | 2.2 | 292 | 2.2 | 298 | 2.2 | 300 | 2.0 | 270 | 2.1 | 286 |
| 3 | 76 | 2.0 | 211 | 2.1 | 232 | 2.1 | 238 | 2.1 | 236 | 2.0 | 215 | 2.1 | 226 |
| 4 | 102 | 1.9 | 156 | 2.1 | 171 | 2.1 | 185 | 2.0 | 185 | 2.0 | 160 | 2.0 | 171 |
| 5 | 127 | 2.0 | 105 | 2.0 | 117 | 2.1 | 133 | 2.0 | 125 | 1.9 | 109 | 2.0 | 118 |
| 6 | 152 | 2.4 | 41 | 2.1 | 47 | 2.1 | 58 | 2.3 | 56 | 2.2 | 45 | 2.2 | 49 |
| 7 | 178 | 0.6 | 0 | 0.8 | 0 | 1.2 | 0 | 0.9 | 0 | 1.0 | 0 | 0.9 | |
| Total Depth of Penetration Inches | | 6.9 | | 7.0 | | 7.1 | | 7.0 | | 7.1 | | Mean Total Depth ins. 7.0 | |
| | | | | | | | | | | | | Standard Deviation 0.09 | |
| Total Volume ccs. | | 507 | | 507 | | 518 | | 506 | | 447 | | Mean Volume ccs. 497 | |
| | | | | | | | | | | | | Standard Deviation 28 | |

Appendix A Table 23

FILLING

RDX/TNT 60/40

LINER

Material: Aluminium
 Cone Angle: 75°
 Wall thickness: 0.940 inches

TARGET

R.H. ARMOUR

| Round No. | | P61 | | P62 | | P71 | | P72 | | P118 | | Mean Hole Diam ins. | Mean Residual Volume ccs. |
|--|-----|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|------------------------------|------------------------------------|
| Plate Nos. | | 32,33 | | 32,33 | | 32,33 | | 32,33 | | 33,46 | | | |
| Depth of Penetration | | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | | |
| Ins. | mm. | | | | | | | | | | | | |
| Crater: | | | 172 | | 205 | | 170 | | 192 | | 185 | | 185 |
| 0 | 0 | 1.7 | 142 | 2.1 | 172 | 1.6 | 140 | 1.7 | 160 | 1.4 | 138 | 1.7 | 150 |
| 1 | 25 | 1.3 | 118 | 1.5 | 132 | 1.2 | 115 | 1.2 | 139 | 1.1 | 117 | 1.3 | 124 |
| 2 | 51 | 1.3 | 95 | 1.3 | 107 | 1.2 | 96 | 1.3 | 118 | 1.3 | 94 | 1.3 | 102 |
| 3 | 76 | 1.3 | 77 | 1.3 | 83 | 1.2 | 80 | 1.3 | 98 | 1.2 | 72 | 1.3 | 82 |
| 4 | 102 | 1.4 | 54 | 1.4 | 58 | 1.1 | 61 | 1.3 | 78 | 1.2 | 55 | 1.3 | 61 |
| 5 | 127 | 1.4 | 32 | 1.5 | 38 | 1.3 | 42 | 1.4 | 53 | 1.2 | 34 | 1.4 | 40 |
| 6 | 152 | 1.5 | 4 | 1.2 | 2 | 1.5 | 5 | 1.6 | 2 | 1.4 | 5 | 1.4 | 4 |
| 7 | 178 | | 0 | | 0 | | 0 | | 0 | | 0 | | |
| Total Depth of Penetration Inches | | 6.2 | | 6.1 | | 6.3 | | 6.2 | | 6.3 | | Mean Total Depth ins. 6.2 | |
| | | | | | | | | | | | | Standard Deviation 0.09 | |
| Total Volume ccs. | | 172 | | 205 | | 170 | | 192 | | 173 | | Mean Volume ccs. 185 | |
| | | | | | | | | | | | | Standard Deviation 15.7 | |

Appendix A Table 24

FILLING
RDX/TNT 60/40

LINER
Material: Aluminium
Cone Angle: 100°
Wall thickness: 0.940 inches

TARGET
R.H. ARMOUR

| Round No. | P47 | | P48 | | P73 | | P74 | | P119 | | Mean Hole Diam ins. | Mean Residual Volume ccs. | |
|--|-----|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|------------------------------------|-----|
| Plate Nos. | 19 | | 19 | | 32 | | 32 | | 33 | | | | |
| Depth of Penetration | | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | | |
| Ins. | mm. | | | | | | | | | | | | |
| Crater: | | | 175 | | 150 | | 164 | | 184 | | 150 | | 165 |
| 0 | 0 | 1.7 | 130 | 1.6 | 104 | 1.6 | 118 | 1.7 | 127 | 1.6 | 105 | 1.6 | 117 |
| 1 | 25 | 1.3 | 105 | 1.3 | 77 | 1.3 | 92 | 1.3 | 102 | 1.2 | 85 | 1.3 | 92 |
| 2 | 51 | 1.5 | 80 | 1.4 | 56 | 1.4 | 78 | 1.5 | 77 | 1.2 | 65 | 1.4 | 71 |
| 3 | 76 | 1.4 | 55 | 1.5 | 33 | 1.5 | 50 | 1.5 | 44 | 1.4 | 41 | 1.5 | 45 |
| 4 | 102 | 1.4 | 25 | 1.2 | 5 | 1.5 | 28 | 1.3 | 14 | 1.4 | 19 | 1.4 | 18 |
| 5 | 127 | | 0 | | 0 | | 0 | | 0 | | 0 | | |
| Total Depth of Penetration Inches | | 4.8 | | 4.3 | | 4.8 | | 4.8 | | 4.8 | | Mean Total Depth ins. 4.7 | |
| | | | | | | | | | | | | Standard Deviation 0.22 | |
| Total Volume ccs. | | 175 | | 150 | | 164 | | 184 | | 150 | | Mean Volume ccs. 165 | |
| | | | | | | | | | | | | Standard Deviation 15.1 | |

ROLLED HOMOGENOUS ARMOURTARGET PLATE PHYSICAL PARAMETERS

| Plate No. | Thickness mm | Yield Tons/sq.in. | U.T.S. Tons/sq.in. | Elong % | Area Reduct. % | B.H.N. | Izod ft. lb. |
|-----------|--------------|-------------------|--------------------|---------|----------------|--------|--------------|
| 19 | 150 | 47.5 | 57.8 | 24.0 | 60.6 | - | 67,68,68 |
| 20 | 150 | 47.2 | 57.2 | 23.0 | 61.7 | - | 70,71,70 |
| 21 | 60 | 50.4 | 57.6 | 21.0 | 60.4 | 262 | 70,72,72 |
| 22 | 60 | 46.8 | 55.2 | 22.0 | 62.8 | 255 | 68,70,70 |
| 23 | 60 | 54.4 | 62.0 | 20.0 | 58.0 | 285 | 68,69,68 |
| 24 | 150 | 46.5 | 57.8 | 25.0 | 60.4 | - | 69,69,70 |
| 25 | 150 | 46.0 | 56.5 | 24.0 | 59.8 | - | 74,73,73 |
| 26 | 60 | 52.4 | 60.8 | 21.0 | 60.4 | 277 | 69,70,70 |
| 27 | 60 | 54.8 | 61.2 | 19.5 | 59.2 | 277 | 70,69,71 |
| 28 | 60 | 54.8 | 62.8 | 20.0 | 58.0 | 285 | 61,63,62 |
| 29 | 60 | 50.0 | 58.4 | 21.0 | 60.4 | 269 | 60,61,58 |
| 30 | 60 | 52.4 | 60.8 | 23.0 | 59.2 | 277 | 72,72,70 |
| 31 | 60 | 52.8 | 60.4 | 22.0 | 59.2 | 277 | 66,68,68 |
| 32 | 150 | 48.3 | 58.5 | 24.0 | 58.6 | - | 67,66,66 |
| 33 | 150 | 45.5 | 56.0 | 25.0 | 63.0 | - | 74,74,73 |
| 46 | 150 | 47.8 | 58.0 | 25.0 | 61.7 | - | 70,70,72 |
| 47 | 60 | 54.0 | 62.0 | 21.0 | 59.2 | 285 | 73,71,71 |
| 53 | 60 | 49.6 | 57.2 | 22.0 | 62.8 | 262 | 72,73,73 |
| 54 | 150 | 46.8 | 57.0 | 24.0 | 61.1 | - | 66,66,66 |
| 55 | 150 | 47.5 | 58.0 | 22.0 | 59.8 | - | 73,72,72 |
| 56 | | | | | | | |
| 57 | | | | | | | |
| 58 | 150 | 48.5 | 58.0 | 24.0 | 64.7 | 271 | 75,73,76 |
| 59 | 150 | 47.5 | 56.5 | 23.5 | 64.2 | 269 | 75,74,75 |
| 60 | 60 | 55.2 | 63.2 | 18.5 | 58.0 | 293 | 66,65,66 |
| 61 | 60 | 50.4 | 58.8 | 20.0 | 59.2 | 269 | 70,69,71 |

ROLLED HOMOGENOUS ARMOUR
TARGET PLATE CHEMICAL COMPOSITIONS

| Plate No. | C % | Si % | S % | P % | Mn % | Ni % | Cr % | Mo % |
|-----------|------|------|-------|-------|------|------|------|------|
| 19 | 0.29 | 0.20 | 0.010 | 0.017 | 0.55 | 0.22 | 3.23 | 0.55 |
| 20 | 0.27 | 0.25 | 0.012 | 0.012 | 0.59 | 0.30 | 3.35 | 0.55 |
| 21 | 0.28 | 0.28 | 0.015 | 0.018 | 0.58 | 0.52 | 1.53 | 0.35 |
| 22 | 0.30 | 0.23 | 0.020 | 0.018 | 0.56 | 0.56 | 1.47 | 0.31 |
| 23 | 0.33 | 0.43 | 0.017 | 0.013 | 0.66 | 0.56 | 1.51 | 0.40 |
| 24 | 0.30 | 0.22 | 0.011 | 0.013 | 0.60 | 0.19 | 3.20 | 0.54 |
| 25 | 0.27 | 0.25 | 0.012 | 0.012 | 0.59 | 0.30 | 3.35 | 0.55 |
| 26 | 0.29 | 0.49 | 0.016 | 0.016 | 0.63 | 0.58 | 1.54 | 0.40 |
| 27 | 0.30 | 0.47 | 0.015 | 0.016 | 0.62 | 0.56 | 1.51 | 0.36 |
| 28 | 0.30 | 0.37 | 0.013 | 0.013 | 0.64 | 0.56 | 1.48 | 0.36 |
| 29 | 0.32 | 0.41 | 0.018 | 0.014 | 0.69 | 0.54 | 1.54 | 0.41 |
| 30 | 0.33 | 0.45 | 0.016 | 0.010 | 0.65 | 0.61 | 1.56 | 0.36 |
| 31 | 0.29 | 0.40 | 0.015 | 0.019 | 0.57 | 0.51 | 1.43 | 0.38 |
| 32 | 0.27 | 0.28 | 0.016 | 0.014 | 0.55 | 0.18 | 3.21 | 0.58 |
| 33 | 0.30 | 0.27 | 0.012 | 0.020 | 0.57 | 0.19 | 3.40 | 0.51 |
| 46 | 0.30 | 0.22 | 0.011 | 0.013 | 0.60 | 0.19 | 3.20 | 0.54 |
| 47 | 0.29 | 0.40 | 0.015 | 0.019 | 0.57 | 0.51 | 1.43 | 0.38 |
| 53 | 0.28 | 0.28 | 0.015 | 0.018 | 0.58 | 0.52 | 1.53 | 0.35 |
| 54 | 0.27 | 0.28 | 0.016 | 0.014 | 0.55 | 0.18 | 3.21 | 0.58 |
| 55 | 0.30 | 0.22 | 0.011 | 0.013 | 0.60 | 0.19 | 3.20 | 0.54 |
| 56 | | | | | | | | |
| 57 | | | | | | | | |
| 58 | 0.26 | 0.20 | 0.010 | 0.015 | 0.60 | 0.14 | 3.40 | 0.53 |
| 59 | 0.29 | 0.25 | 0.014 | 0.016 | 0.60 | 0.12 | 3.29 | 0.54 |
| 60 | 0.33 | 0.43 | 0.017 | 0.013 | 0.66 | 0.56 | 1.51 | 0.40 |
| 61 | 0.30 | 0.47 | 0.015 | 0.016 | 0.62 | 0.56 | 1.51 | 0.36 |

FILLINGLINERTARGET

RDX/TNT 60/40

Material: Steel

MILD STEEL

Cone Angle: 75°

Wall thickness: 0.160 inches

| Round No. | | P1 | | P2 | | P3 | | P6 | | | | | |
|--|------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|-----------------------|-------------------------------|----------------------|-------------------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 1,2,3, 4,5,6, | | 1,2,3, 4,5,6, | | 1,2,3, 4,5,6 | | 1,2,3, 4,5,6, 7 | | | | Mean Hole Diam ins. | Mean Residual Volume ccs. |
| Depth of Penetration | | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | | |
| Ins. | mms. | | | | | | | | | | | | |
| Crater: | | | 1088 | | 1024 | | 993 | | 946 | | | | 1013 |
| 0 | 0 | 3.1 | 1010 | 3.2 | 962 | 3.2 | 925 | 3.1 | 871 | | | 3.2 | 942 |
| 1 | 25 | 2.9 | 898 | 2.8 | 845 | 2.9 | 808 | 3.0 | 751 | | | 2.9 | 826 |
| 2 | 51 | 2.8 | 802 | 2.7 | 745 | 2.5 | 720 | 2.7 | 644 | | | 2.7 | 728 |
| 3 | 76 | 2.5 | 690 | 2.6 | 633 | 2.6 | 621 | 2.2 | 580 | | | 2.5 | 631 |
| 4 | 102 | 2.5 | 603 | 2.5 | 548 | 2.6 | 542 | 2.4 | 511 | | | 2.5 | 551 |
| 5 | 127 | 2.2 | 487 | 2.1 | 439 | 2.8 | 425 | 2.2 | 418 | | | 2.2 | 442 |
| 6 | 152 | 2.2 | 432 | 2.1 | 381 | 2.3 | 366 | 2.2 | 357 | | | 2.2 | 384 |
| 7 | 178 | 1.9 | 323 | 2.1 | 299 | 2.0 | 268 | 2.0 | 284 | | | 2.0 | 294 |
| 8 | 203 | 1.8 | 276 | 1.7 | 259 | 1.8 | 218 | 1.7 | 245 | | | 1.8 | 249 |
| 9 | 228 | 1.8 | 228 | 1.9 | 217 | 1.8 | 181 | 1.8 | 197 | | | 1.8 | 206 |
| 10 | 254 | 1.4 | 146 | 1.5 | 144 | 1.4 | 133 | 1.5 | 157 | | | 1.5 | 145 |
| 11 | 279 | 1.6 | 118 | 1.6 | 116 | 1.7 | 100 | 1.5 | 132 | | | 1.6 | 117 |
| 12 | 304 | 1.4 | 89 | 1.6 | 87 | 1.5 | 71 | 1.4 | 101 | | | 1.5 | 87 |
| 13 | 330 | 1.3 | 34 | 1.3 | 30 | 1.4 | 25 | 1.3 | 58 | | | 1.3 | 37 |
| 14 | 355 | 1.2 | 15 | 1.2 | 8 | 1.0 | 12 | 1.3 | 36 | | | 1.2 | 18 |
| 15 | 381 | 0.7 | 0 | | 0 | | 0 | 1.2 | 14 | | | | |
| 16 | 406 | | | | | | | | 0 | | | | |
| Total Depth of Penetration Inches | | 15.0 | | 14.6 | | 14.4 | | 15.8 | | | | Mean Total Depth ins. 15.0 | |
| | | | | | | | | | | | | Standard Deviation 0.61 | |
| Total Volume ccs. | | 1088 | | 1024 | | 993 | | 946 | | | | Mean Volume ccs. 1013 | |
| | | | | | | | | | | | | Standard Deviation 59 | |

FILLING
RDX/TNT 60/40

LINER
Material: Steel
Cone Angle: 100°
Wall thickness: 0.160

TARGET
MILD STEEL

| Round No. | | P17 | | P18 | | P19 | | P20 | | P21 | | Mean Hole Diam ins. | Mean Residual Volume ccs. |
|--|------|----------------------------|-----------------------|----------------------------|-----------------------|----------------------------|-----------------------|----------------------------|-----------------------|----------------------------|-----------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 12,13,14 15,16,17 18 | | 12,13,14 15,16,17 18 | | 12,13,14 15,16,17 18 | | 12,13,14 15,16,17 18 | | 12,13,14 15,16,17 18 | | | |
| Depth of Penetration | | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mms. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Crater: | | | 1234 | | 1292 | | 1281 | | 1184 | | 1288 | | 1260 |
| 0 | 0 | 2.6 | 1163 | 2.7 | 1176 | 2.8 | 1192 | 2.9 | 1085 | 3.0 | 1170 | 2.8 | 1157 |
| 1 | 25 | 2.9 | 1052 | 2.9 | 1092 | 2.9 | 1072 | 2.8 | 980 | 3.0 | 1060 | 2.9 | 1051 |
| 2 | 51 | 2.7 | 955 | 2.7 | 985 | 2.7 | 971 | 2.9 | 880 | 3.0 | 942 | 2.8 | 947 |
| 3 | 76 | 2.7 | 843 | 2.7 | 853 | 2.7 | 863 | 2.4 | 777 | 2.9 | 792 | 2.7 | 826 |
| 4 | 102 | 2.7 | 754 | 2.8 | 745 | 2.9 | 766 | 2.7 | 691 | 2.9 | 684 | 2.8 | 728 |
| 5 | 127 | 2.5 | 621 | 2.5 | 613 | 2.4 | 631 | 2.5 | 560 | 2.5 | 551 | 2.5 | 595 |
| 6 | 152 | 2.5 | 543 | 2.5 | 530 | 2.5 | 551 | 2.5 | 481 | 2.7 | 468 | 2.55 | 515 |
| 7 | 178 | 2.1 | 412 | 2.3 | 390 | 2.3 | 393 | 2.3 | 363 | 2.4 | 330 | 2.35 | 378 |
| 8 | 203 | 2.6 | 336 | 2.6 | 312 | 2.7 | 309 | 2.6 | 290 | 2.3 | 262 | 2.6 | 302 |
| 9 | 228 | 2.1 | 210 | 1.8 | 165 | 2.1 | 166 | 2.1 | 148 | 1.7 | 120 | 2.0 | 162 |
| 10 | 254 | 1.4 | 172 | 1.5 | 135 | 1.8 | 127 | 1.6 | 109 | 1.5 | 90 | 1.6 | 127 |
| 11 | 279 | 1.4 | 86 | 1.7 | 36 | 1.4 | 76 | 1.7 | 52 | 1.5 | 23 | 1.55 | 55 |
| 12 | 304 | 1.6 | 57 | 1.3 | 0 | 1.8 | 43 | 1.5 | 27 | 0.8 | 0 | 1.4 | 25 |
| 13 | 330 | 0.7 | 0 | | | | 0 | | 0 | | | | |
| Total Depth of Penetration Inches | | 13.0 | | 12.2 | | 12.7 | | 12.4 | | 12.0 | | Mean Total Depth ins. 12.5 | |
| | | | | | | | | | | | | Standard Deviation 0.4 | |
| Total Volume ccs. | | 1234 | | 1292 | | 1281 | | 1184 | | 1288 | | Mean Volume ccs. 1260 | |
| | | | | | | | | | | | | Standard Deviation 51 | |

FILLING
RDX/TNT 60/40

LINER
Material: Aluminium
Cone Angle: 45°
Wall thickness: 0.940 inches

TARGET
MILD STEEL

| Round No. | | P7 | | P8 | | P9 | | P13 | | P14 | | Mean Hole Diam ins. | Mean Residual Volume ccs. |
|--|-----|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------------|-------------------------------|----------------------------|-------------------------------|-------------------------------|------------------------------------|
| Plate Nos. | | 4,5,6, 7,18 | | 4,5,6, 7,18 | | 4,5,6, 7,18 | | 8,9,10, 11,12,13, 14 | | 8,9,10, 11,12,13, 14 | | | |
| Depth of Penetration | | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | | |
| Ins. | mm. | | | | | | | | | | | | |
| Crater: | | | 382 | | 336 | | 399 | | 382 | | 368 | | 375 |
| 0 | 0 | 1.8 | 363 | 1.8 | 320 | 1.7 | 380 | 1.8 | 366 | 1.8 | 356 | 1.8 | 357 |
| 1 | 25 | 1.6 | 337 | 1.5 | 295 | 1.6 | 349 | 1.5 | 337 | 1.5 | 331 | 1.55 | 330 |
| 2 | 51 | 2.1 | 272 | 2.0 | 253 | 2.2 | 304 | 1.8 | 293 | 1.8 | 288 | 2.0 | 282 |
| 3 | 76 | 1.8 | 212 | 1.7 | 200 | 1.8 | 229 | 1.8 | 248 | 1.8 | 240 | 1.8 | 226 |
| 4 | 102 | 1.6 | 172 | 1.6 | 154 | 1.6 | 188 | 1.6 | 203 | 1.7 | 198 | 1.6 | 183 |
| 5 | 127 | 1.7 | 135 | 1.6 | 124 | 1.7 | 155 | 1.5 | 164 | 1.6 | 160 | 1.6 | 148 |
| 6 | 152 | 1.5 | 101 | 1.4 | 89 | 1.6 | 117 | 1.6 | 133 | 1.5 | 130 | 1.5 | 114 |
| 7 | 178 | 1.2 | 76 | 1.3 | 62 | 1.3 | 88 | 1.2 | 99 | 1.3 | 91 | 1.3 | 83 |
| 8 | 203 | 1.2 | 57 | 1.2 | 45 | 1.3 | 71 | 1.4 | 73 | 1.3 | 69 | 1.3 | 63 |
| 9 | 228 | 1.0 | 42 | 1.0 | 28 | 1.2 | 43 | 1.0 | 43 | 1.0 | 50 | 1.05 | 41 |
| 10 | 254 | 0.9 | 25 | 0.8 | 14 | 0.9 | 30 | 1.0 | 33 | 0.9 | 34 | 0.9 | 27 |
| 11 | 279 | 1.0 | 18 | 0.7 | 5 | 1.0 | 20 | 0.9 | 13 | 0.8 | 17 | 0.9 | 15 |
| 12 | 304 | 0.5 | 0 | 0.6 | 3 | 1.2 | 3 | 0.7 | 0 | 1.0 | 3 | 0.8 | 2 |
| 13 | 330 | | | | 0 | | 0 | | | | 0 | | |
| Total Depth of Penetration Inches | | 12.1 | | 12.3 | | 12.2 | | 12.1 | | 12.2 | | Mean Total Depth ins. 12.2 | |
| | | | | | | | | | | | | Standard Deviation 0.09 | |
| Total Volume ccs. | | 382 | | 336 | | 399 | | 382 | | 368 | | Mean Volume ccs. 375 | |
| | | | | | | | | | | | | Standard Deviation 23.6 | |

SECRET-DISCREET

Appendix C Rable 4

FILLING
RDX/TNT 60/40

LINER
Material: Aluminium
Cone Angle : 75°
Wall thickness : 0.940 inches

TARGET
MILD STEEL

| Round No. | | P4 | | P5 | | P15 | | P16 | | | | Mean Hole Diam ins. | Mean Residual Volume ccs. |
|--|-----|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|------------------------------|------------------------------------|
| Plate Nos. | | 1,2,3, 4 | | 1,2,3, 4 | | 8,9,10, 11,12. | | 8,9,10, 11,12. | | | | | |
| Depth of Penetration | | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | Hole Diam ins. | Resi- dual Vol. ccs. | | |
| Ins. | mm. | | | | | | | | | | | | |
| Crater: | | | 361 | | 320 | | 328 | | 335 | | | | 336 |
| 0 | 0 | 3.5 | 339 | 3.4 | 276 | 3.4 | 294 | 3.5 | 295 | | | 3.55 | 301 |
| 1 | 25 | 1.7 | 223 | 1.5 | 194 | 1.6 | 233 | 1.6 | 228 | | | 1.6 | 220 |
| 2 | 51 | 1.2 | 193 | 1.1 | 174 | 1.3 | 208 | 1.3 | 205 | | | 1.2 | 195 |
| 3 | 76 | 1.5 | 152 | 1.6 | 140 | 1.6 | 171 | 1.5 | 167 | | | 1.55 | 158 |
| 4 | 102 | 1.5 | 123 | 1.4 | 111 | 1.5 | 145 | 1.5 | 138 | | | 1.5 | 129 |
| 5 | 127 | 1.4 | 84 | 1.4 | 76 | 1.3 | 111 | 1.3 | 102 | | | 1.35 | 93 |
| 6 | 152 | 1.4 | 58 | 1.3 | 55 | 1.4 | 87 | 1.3 | 79 | | | 1.35 | 70 |
| 7 | 178 | 1.1 | 27 | 1.1 | 30 | 1.3 | 45 | 1.2 | 44 | | | 1.2 | 37 |
| 8 | 203 | 1.2 | 6 | 1.2 | 12 | 1.4 | 20 | 1.4 | 20 | | | 1.3 | 15 |
| 9 | 228 | | 0 | | 0 | | 0 | | ● | | | | |
| Total Depth of Penetration Inches | | 8.5 | | 8.8 | | 8.3 | | 8.7 | | | | Mean Total Depth ins. 8.6 | |
| | | | | | | | | | | | | Standard Deviation 0.22 | |
| Total Volume ccs. | | 361 | | 320 | | 328 | | 335 | | | | Mean Volume ccs. 336 | |
| | | | | | | | | | | | | Standard Deviation 17.8 | |

FILLING

RDX/TNT 60/40

LINER

Material: Aluminium
 Cone Angle: 100°
 Wall thickness: 0.940 inches

TARGET

MILD STEEL

| Round No. | | P10 | | P11 | | P12 | | | | | | Mean Hole Diam ins. | Mean Residual Volume ccs. |
|--|-----|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|------------------------------|------------------------------------|
| Plate Nos. | | 4,5,6 | | 4,5 | | 4,5,6 | | | | | | | |
| Depth of Penetration | | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | Hole Diam | Resi- dual Vol. | | |
| Ins. | mm. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | ins. | ccs. | | |
| Crater: | | | 299 | | 286 | | 321 | | | | | | 302 |
| 0 | 0 | 2.2 | 225 | 2.0 | 213 | 2.1 | 248 | | | | | 2.1 | 229 |
| 1 | 25 | 1.2 | 195 | 1.2 | 183 | 1.3 | 214 | | | | | 1.2 | 197 |
| 2 | 51 | 1.4 | 176 | 1.3 | 162 | 1.5 | 188 | | | | | 1.4 | 175 |
| 3 | 76 | 1.6 | 141 | 1.6 | 132 | 1.5 | 153 | | | | | 1.6 | 142 |
| 4 | 102 | 2.3 | 80 | 2.3 | 72 | 2.5 | 73 | | | | | 2.4 | 75 |
| 5 | 127 | 1.7 | 28 | 1.7 | 22 | 1.7 | 22 | | | | | 1.7 | 24 |
| 6 | 152 | 1.1 | 5 | | 0 | 0.6 | 0 | | | | | | |
| 7 | 178 | | 0 | | | | | | | | | | |
| Total Depth of Penetration Inches | | 6.3 | | 5.9 | | 6.1 | | | | | | Mean Total Depth ins. 6.1 | |
| | | | | | | | | | | | | Standard Deviation - | |
| Total Volume ccs. | | 299 | | 286 | | 321 | | | | | | Mean Volume ccs. 302 | |
| | | | | | | | | | | | | Standard Deviation - | |

MILD STEELTARGET PLATE PHYSICAL PARAMETERS

| Plate No. | Thickness ins. | Yield Tons/sq.in. | U.T.S. Tons/sq.in. | Elong. % | Area Reduct. % | B.H.N. | Izod ft. lb. |
|-----------|----------------|-------------------|--------------------|----------|----------------|--------|--------------|
| 1 | 2 | 15.2 | 27.7 | 39 | 61 | 116 | 44,36,52 |
| 2 | 2 | 14.3 | 27.2 | 38 | 63 | 116 | 56,54,54 |
| 3 | 2 | 14.6 | 27.9 | 39 | 61 | 108 | 45,41,37 |
| 4 | 3 | 14.7 | 25.4 | 40 | 64 | 118 | 36,47,39 |
| 5 | 3 | 15.7 | 28.0 | 38 | 60 | 131 | 38,39,36 |
| 6 | 3 | 11.9 | 26.6 | 39 | 58 | 113 | 41,35,40 |
| 7 | 3 | 14.2 | 26.6 | 40 | 63 | 119 | 51,52,35 |
| 8 | 2 | 14.0 | 28.5 | 38 | 58 | 124 | 27,40,32 |
| 9 | 2 | 15.4 | 27.6 | 39 | 60 | 131 | 41,44,42 |
| 10 | 2 | 15.8 | 29.0 | 38 | 59 | 131 | 33,29,30 |
| 11 | 2 | 14.9 | 29.8 | 36 | 56 | 120 | 26,28,30 |
| 12 | 2 | 12.5 | 24.2 | 38 | 59 | 123 | 30,33,37 |
| 13 | 2 | 14.4 | 27.6 | 39 | 62 | 119 | 37,40,46 |
| 14 | 2 | 15.6 | 27.8 | 39 | 62 | 115 | 43,45,37 |
| 15 | 2 | 12.0 | 28.1 | 37 | 57 | 124 | 36,28,26 |
| 16 | 2 | 15.1 | 28.0 | 38 | 61 | 123 | 44,41,47 |
| 17 | 2 | 13.2 | 27.6 | 38 | 60 | 116 | 40,58,42 |
| 18 | 3 | 12.4 | 28.8 | 38 | 61 | 124 | 35,34,36 |

MILD STEELTARGET PLATE CHEMICAL COMPOSITIONS

| Plate No. | C % | Si % | Mn % | Ni % | Cr % | Mo % | V % | Cu % | Al % |
|-----------|--------|---------|---------|---------|---------|---------|--------|---------|---------|
| 1 | 0.14 | 0.07 | 0.61 | 0.03 | 0.02 | <0.01 | <0.01 | 0.07 | <0.005 |
| 2 | 0.19 | 0.08 | 0.66 | 0.04 | 0.02 | " | " | 0.07 | <0.005 |
| 3 | 0.17 | 0.08 | 0.66 | 0.05 | 0.02 | " | " | 0.07 | <0.005 |
| 4 | 0.14 | 0.08 | 0.52 | 0.07 | 0.01 | " | " | 0.11 | 0.015 |
| 5 | 0.17 | 0.07 | 0.61 | 0.19 | 0.03 | " | " | 0.26 | <0.005 |
| 6 | 0.17 | 0.10 | 0.59 | 0.05 | 0.06 | " | " | 0.07 | 0.015 |
| 7 | 0.19 | 0.05 | 0.62 | 0.05 | 0.02 | " | " | 0.07 | 0.015 |
| 8 | 0.22 | 0.06 | 0.60 | 0.05 | <0.01 | " | " | 0.15 | 0.010 |
| 9 | 0.20 | 0.07 | 0.67 | 0.03 | 0.01 | " | " | 0.12 | 0.005 |
| 10 | 0.19 | 0.09 | 0.78 | 0.06 | 0.02 | " | " | 0.11 | <0.005 |
| 11 | 0.21 | 0.06 | 0.67 | 0.05 | 0.01 | " | " | 0.07 | 0.005 |
| 12 | 0.22 | 0.05 | 0.58 | 0.05 | <0.01 | " | " | 0.15 | <0.005 |
| 13 | 0.19 | 0.07 | 0.66 | 0.05 | 0.01 | " | " | 0.09 | 0.005 |
| 14 | 0.19 | 0.08 | 0.60 | 0.06 | 0.01 | " | " | 0.10 | <0.005 |
| 15 | 0.22 | 0.10 | 0.58 | 0.05 | 0.01 | " | " | 0.12 | 0.015 |
| 16 | 0.17 | 0.06 | 0.60 | 0.04 | 0.03 | " | " | 0.07 | <0.005 |
| 17 | 0.18 | 0.09 | 0.66 | 0.05 | 0.02 | " | " | 0.08 | 0.005 |
| 18 | 0.15 | 0.10 | 0.58 | 0.05 | 0.02 | " | " | 0.07 | 0.005 |

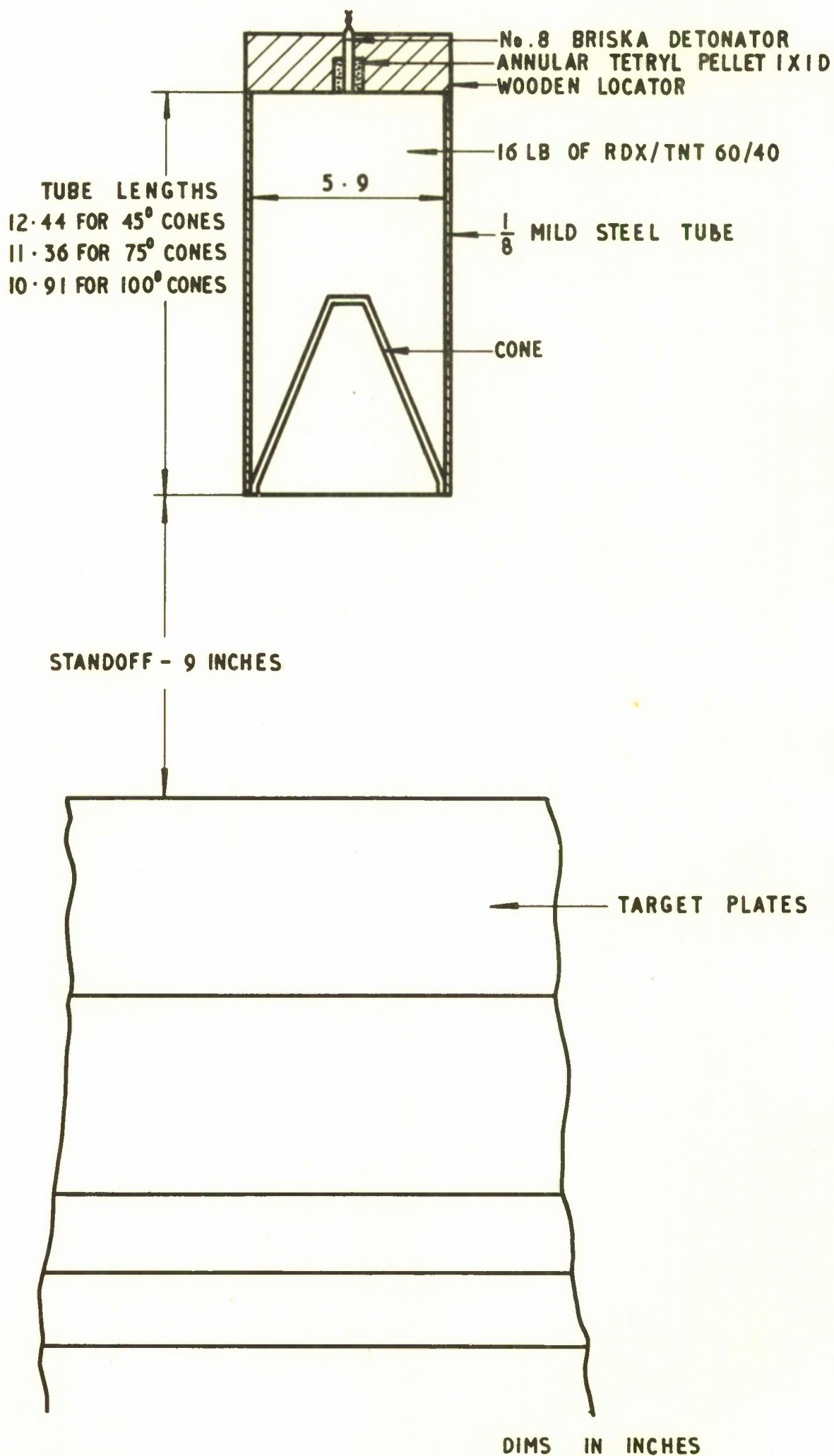
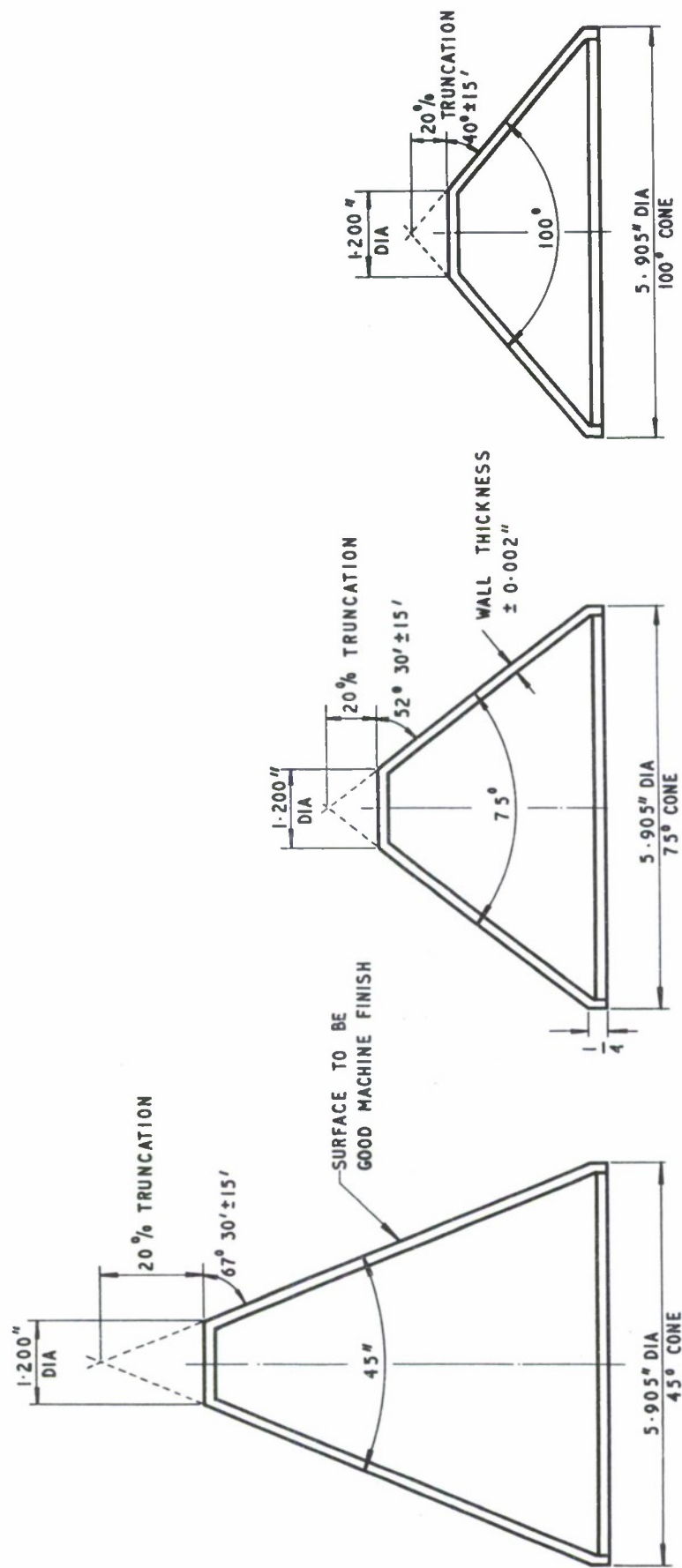


FIG. 1 SCHEMATIC DIAGRAM OF CHARGE AND TARGET LAYOUT



| MATERIAL | SPECIFICATION | WALL THICKNESS (INCHES) | UTS | % AGE ELONGATION |
|-----------------|------------------------|-------------------------|--------------|------------------|
| COPPER | BS 1433 MEDIUM HARD | 0.088 0.140 0.280 | 16 TONS/SQIN | 20 % |
| STEEL | BS. 970 EN 3A | 0.100 0.160 0.320 | 28 TONS/SQIN | 25 % |
| ALUMINIUM ALLOY | BS 1476 HE 10 WP | 0.300 0.470 0.980 | 18 TONS/SQIN | 10 % |

FIG. 2 TYPES OF CONES

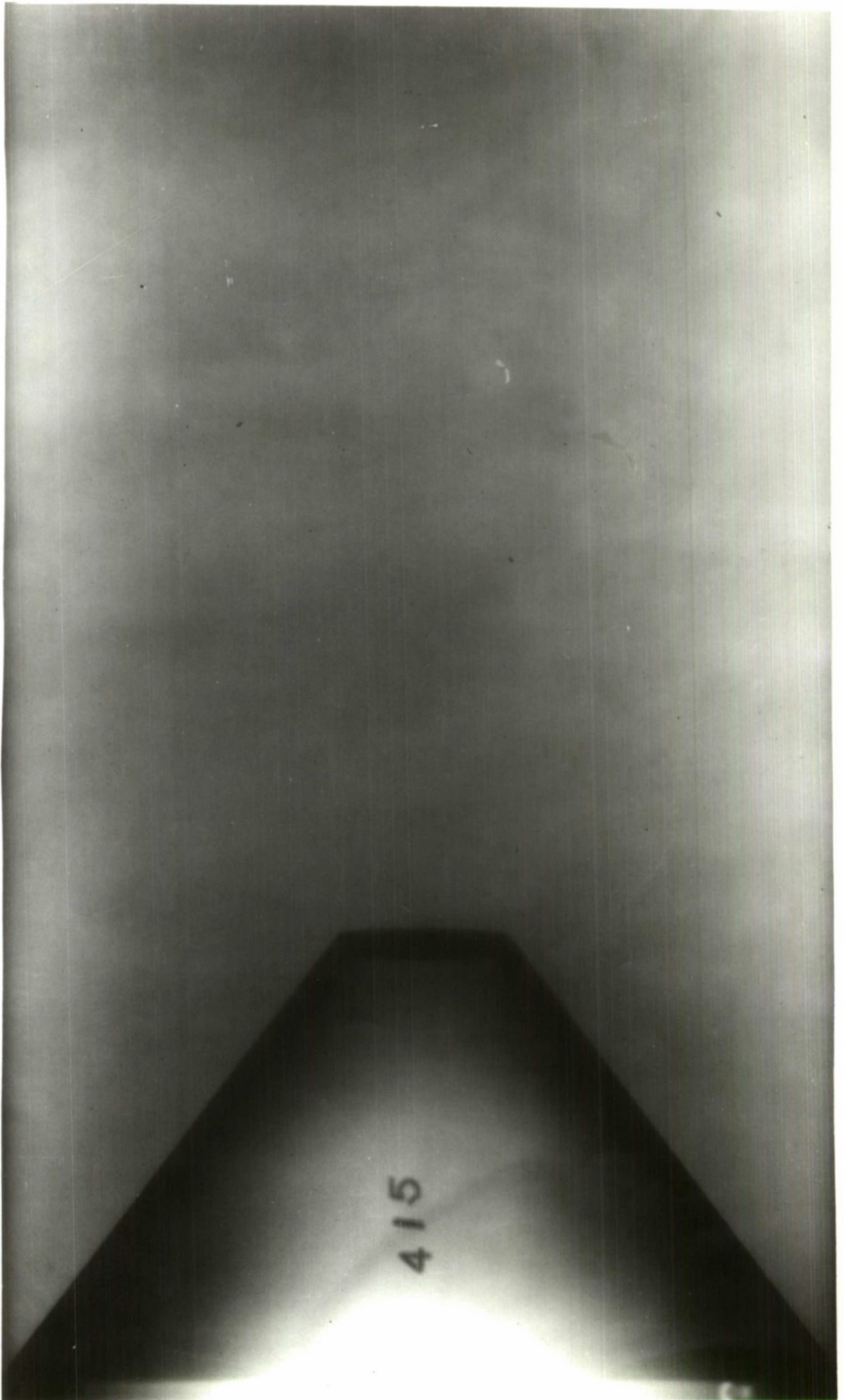


FIG. 3 RADIOGRAPH OF CHARGE

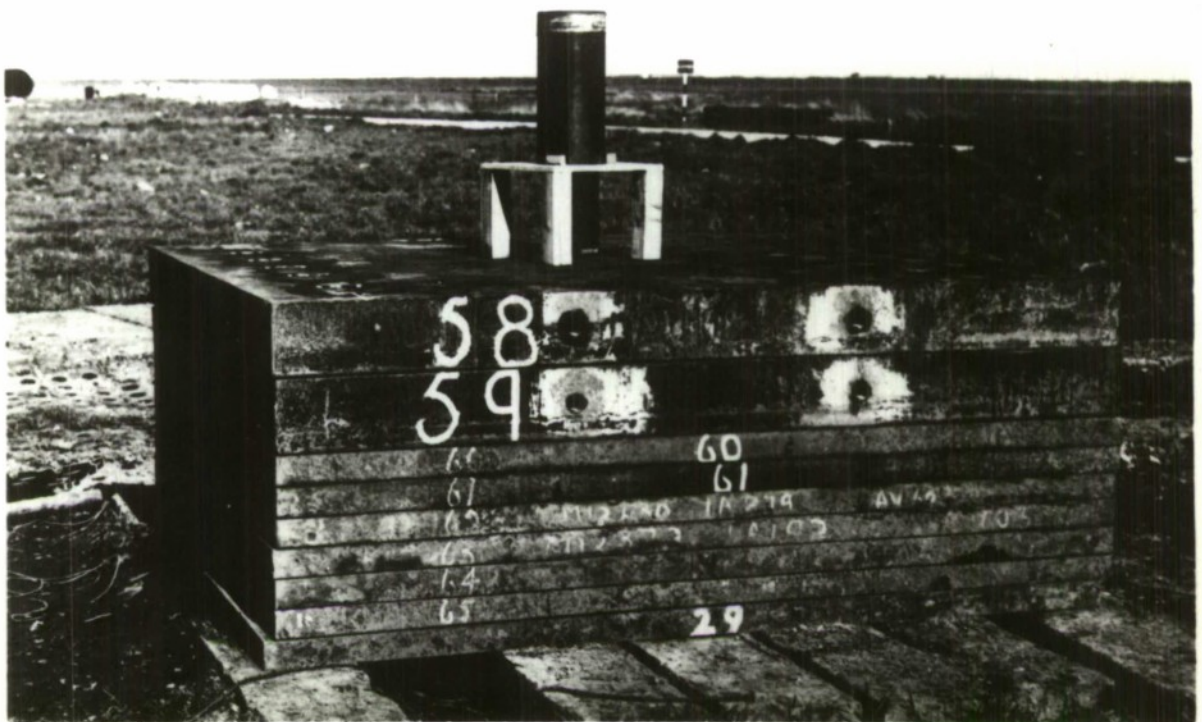


FIG. 4 SEMI-INFINITE TARGET SHOWING CHARGE AND STAND

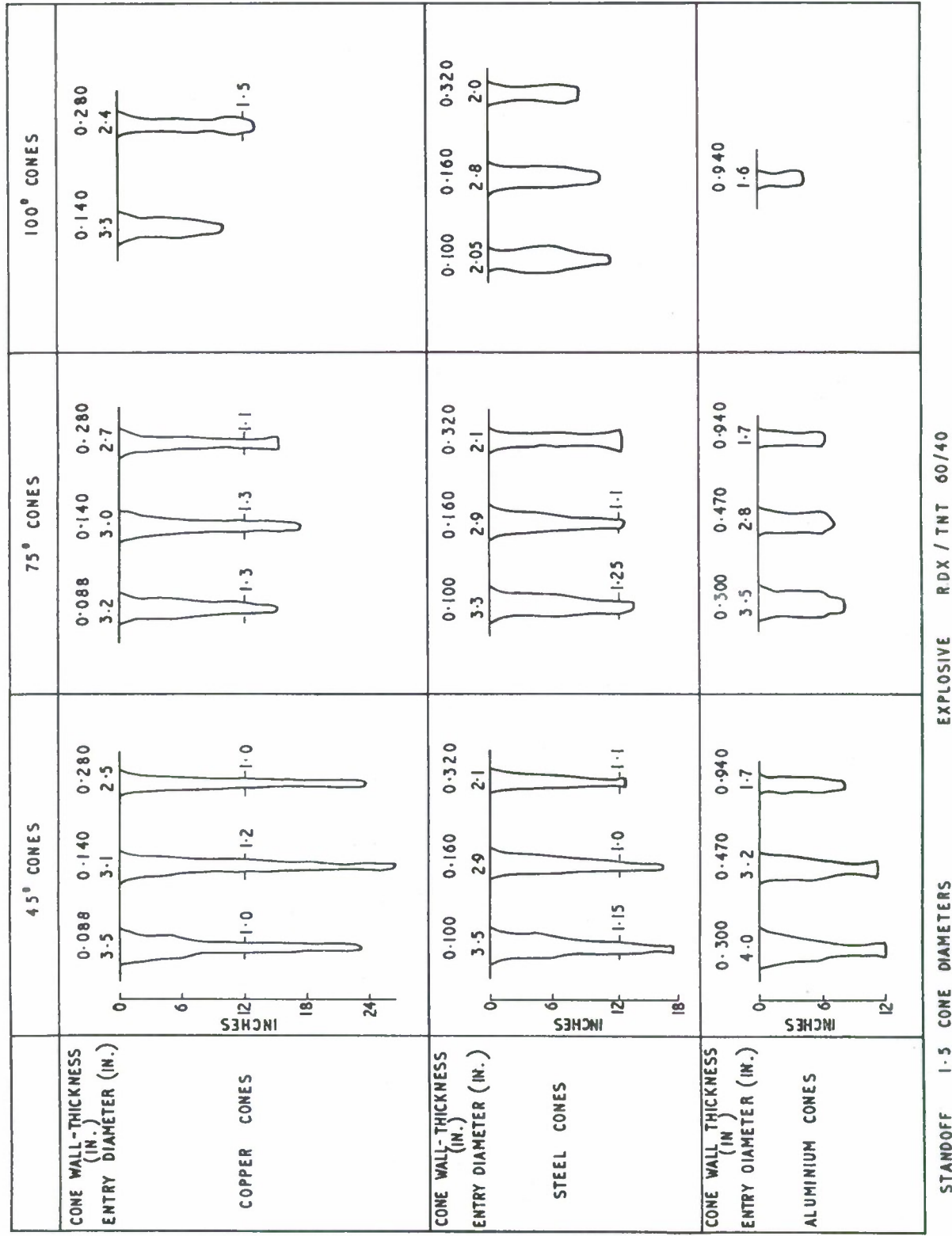
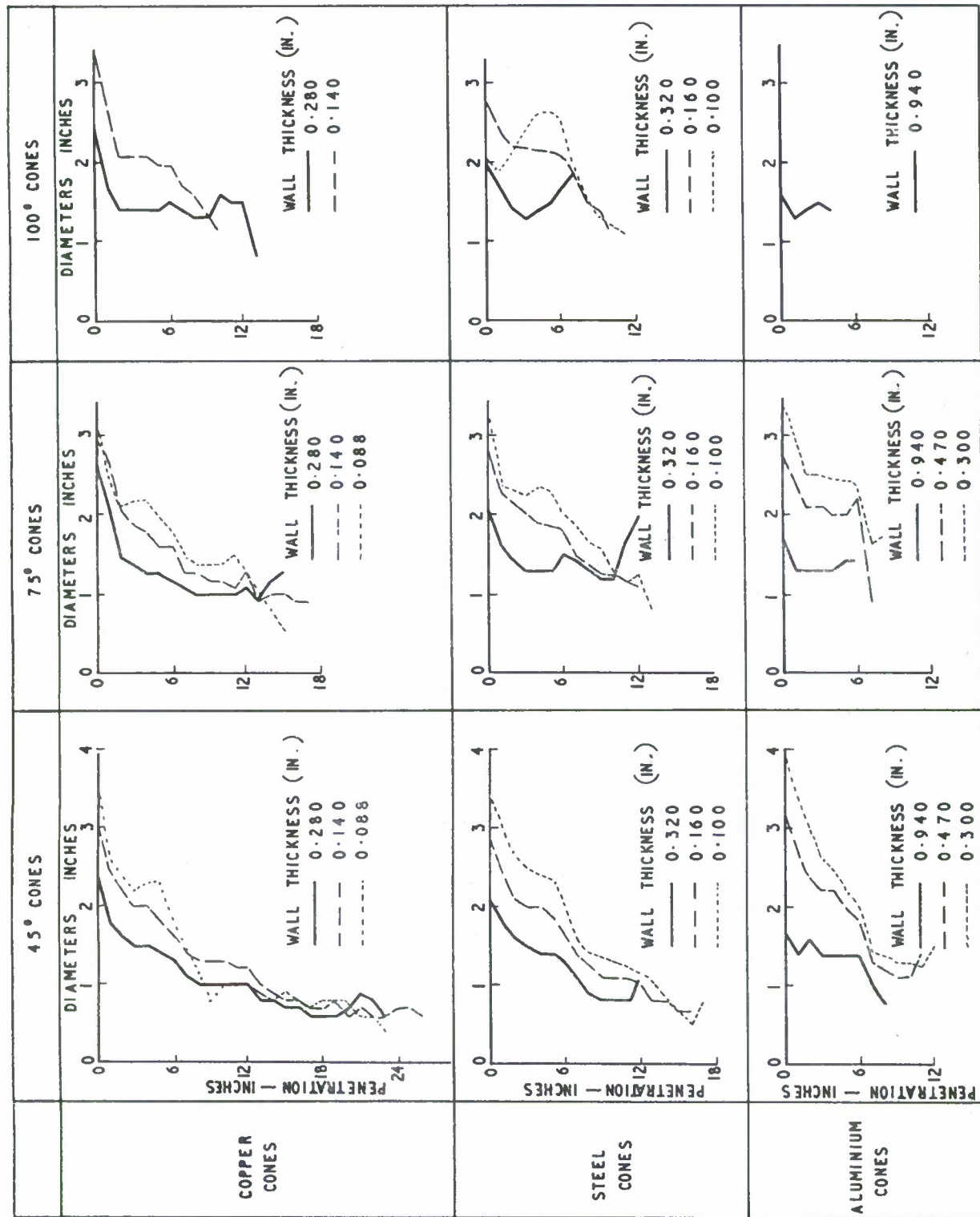


FIG. 5 COMPARISON OF CRATER PROFILES IN R H ARMOUR WITH CHANGE OF LINER MATERIAL CONE ANGLE AND WALL THICKNESS



STANDOFF 1.5 CONE DIAMETERS EXPLOSIVE RDX / TNT 60 / 40

FIG. 6 COMPARISON OF CRATER DIAMETER VS DEPTH OF PENETRATION
IN RH ARMOUR WITH CHANGE OF LINER WALL THICKNESS

| | |
|----------------|-----------------|
| MATERIAL | COPPER |
| CONE ANGLE | 45° |
| WALL THICKNESS | 0.140 IN. |
| FILLING | RDX / TNT 60/40 |
| TARGET | R H ARMOUR |

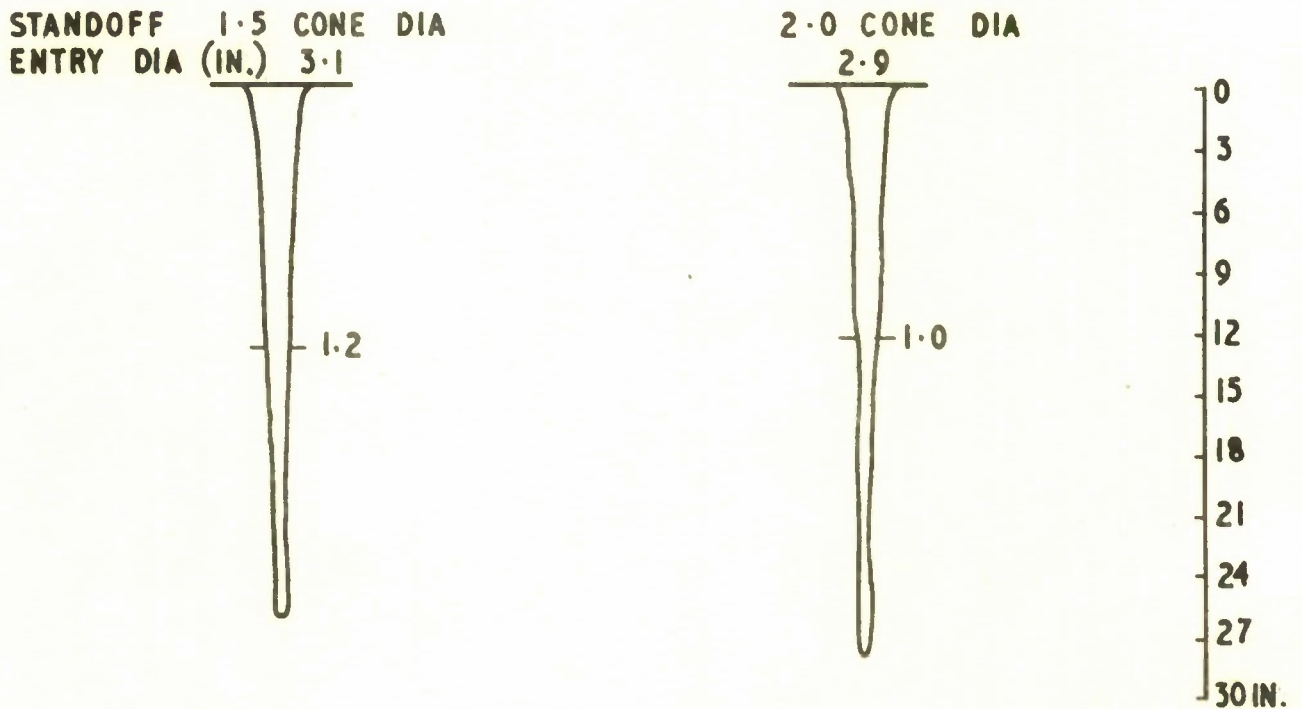


FIG. 7 (a) EFFECT OF STANDOFF ON CRATER PROFILE

| | |
|----------------|--------------|
| MATERIAL | COPPER |
| CONE ANGLE | 75° |
| WALL THICKNESS | 0.140 IN. |
| STANDOFF | 1.5 CONE DIA |
| TARGET | R H ARMOUR |

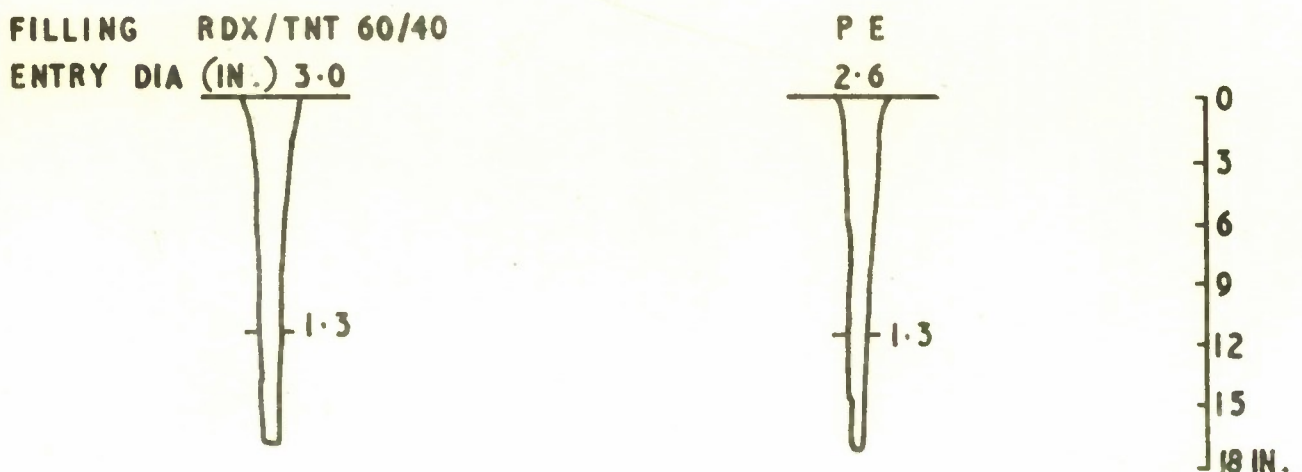


FIG. 7 (b) EFFECT OF EXPLOSIVE FILLING ON CRATER PROFILE

FIG. 8

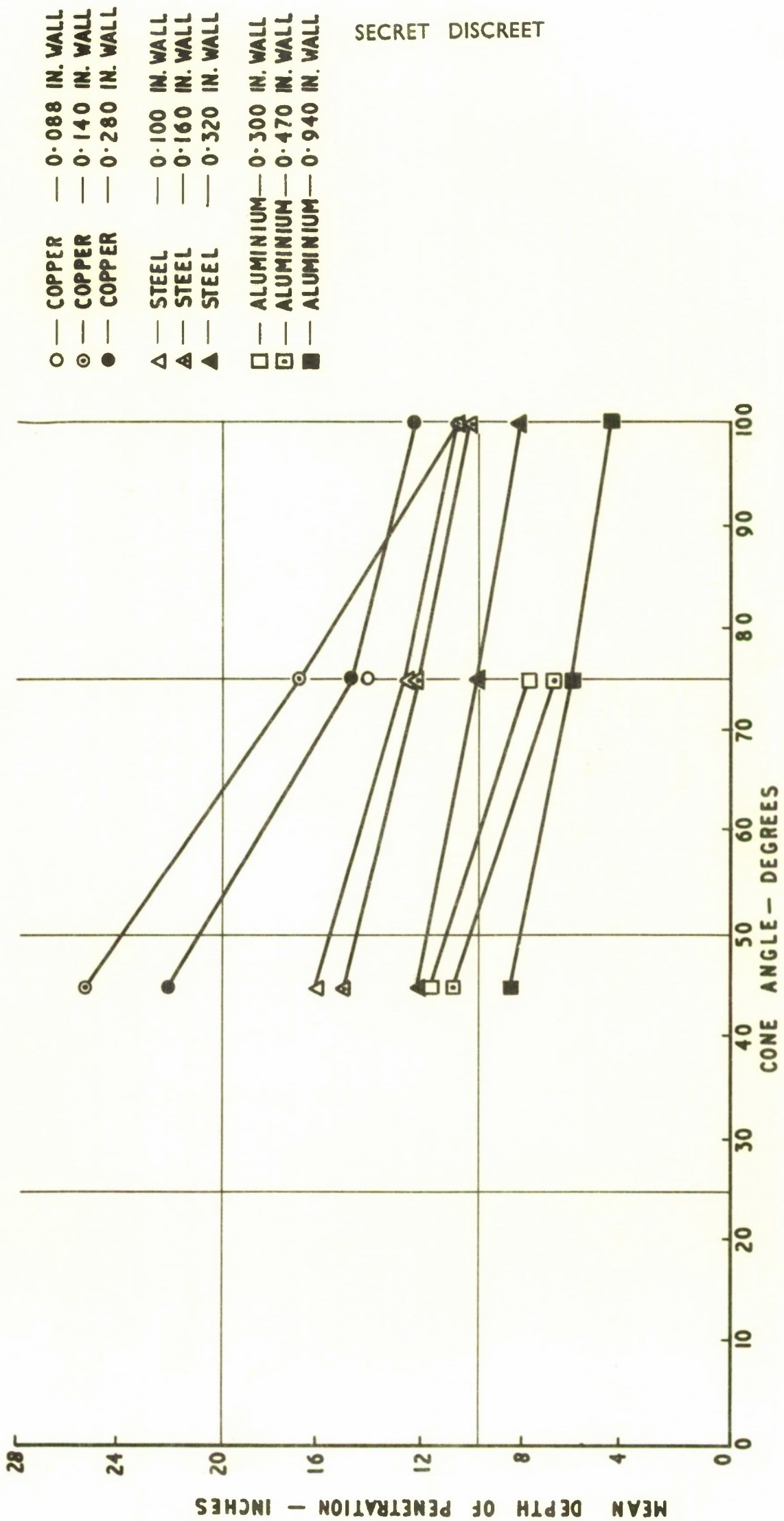
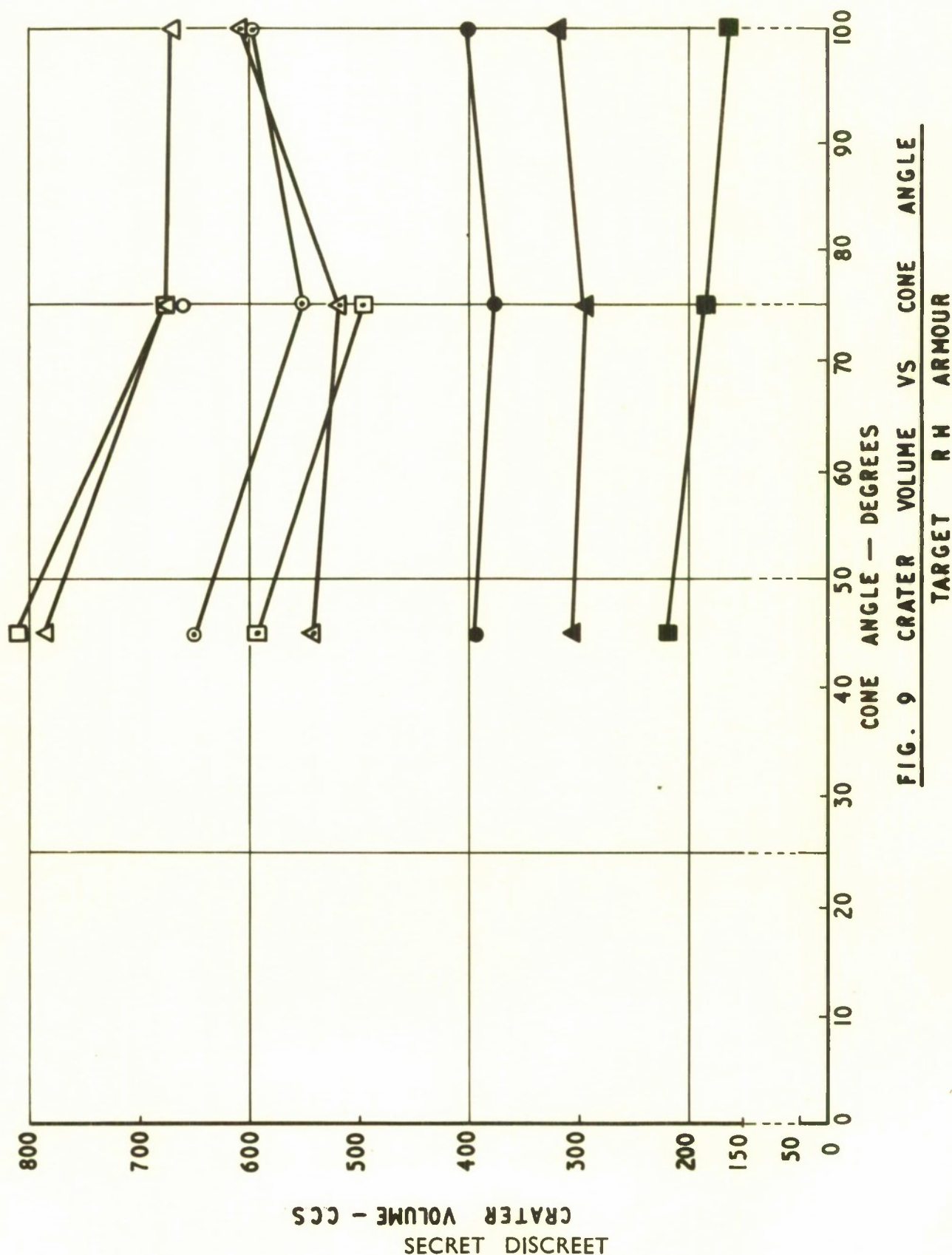


FIG. 8 MEAN DEPTH OF PENETRATION VS CONE ANGLE
TARGET RH ARMOUR

FIG. 9



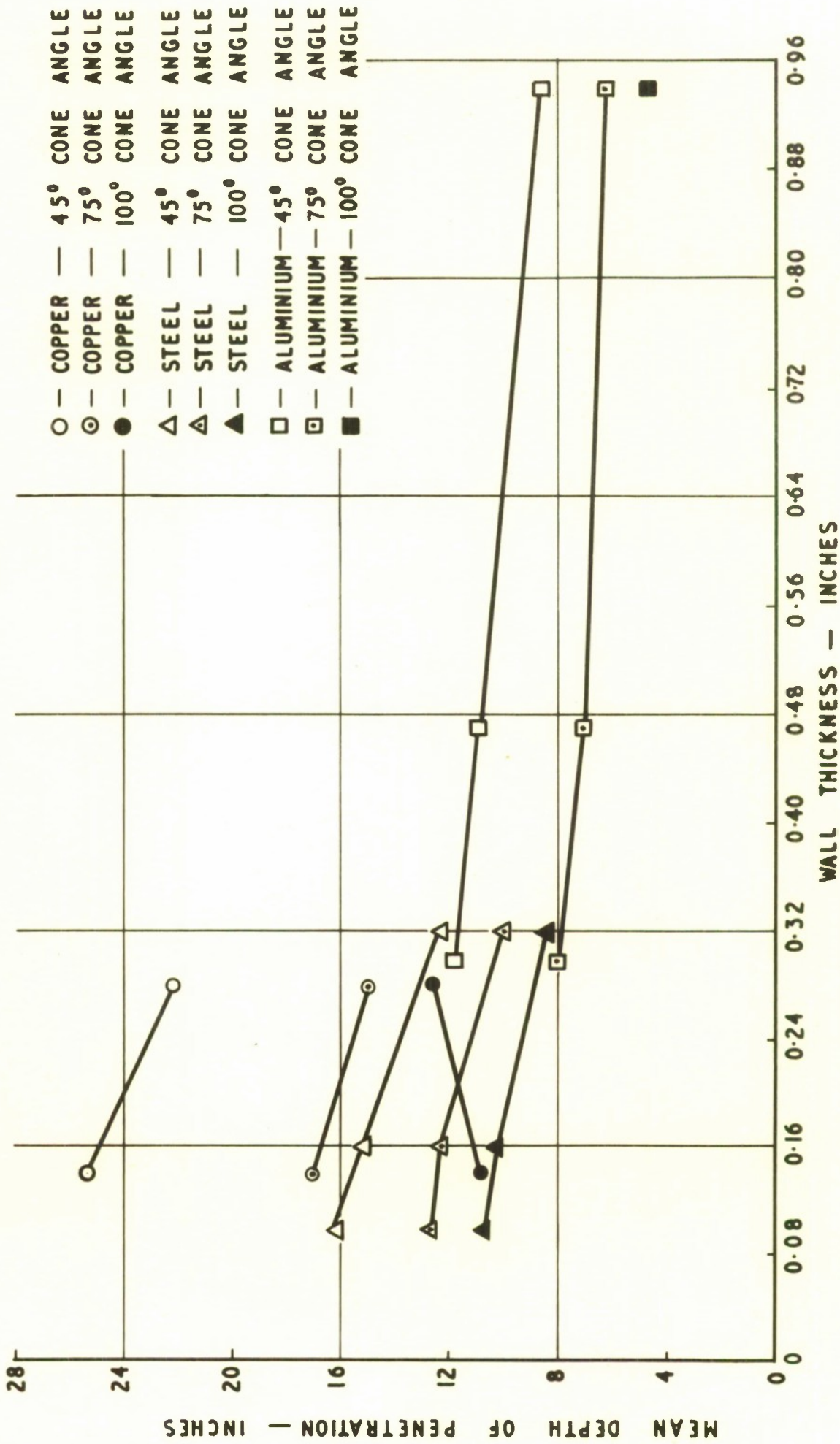


FIG. 10 MEAN DEPTH OF PENETRATION VS WALL THICKNESS

FIG. 11

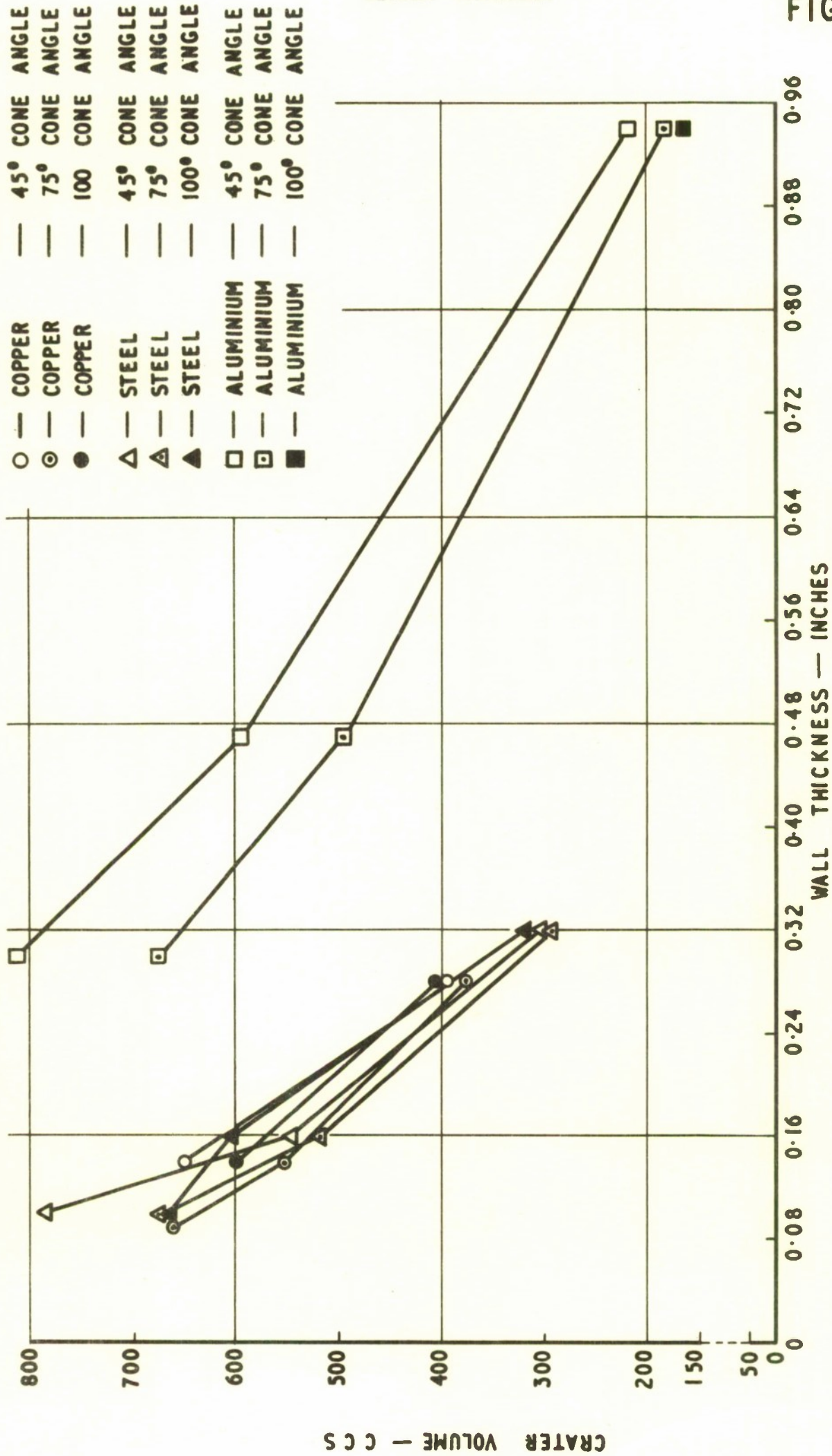
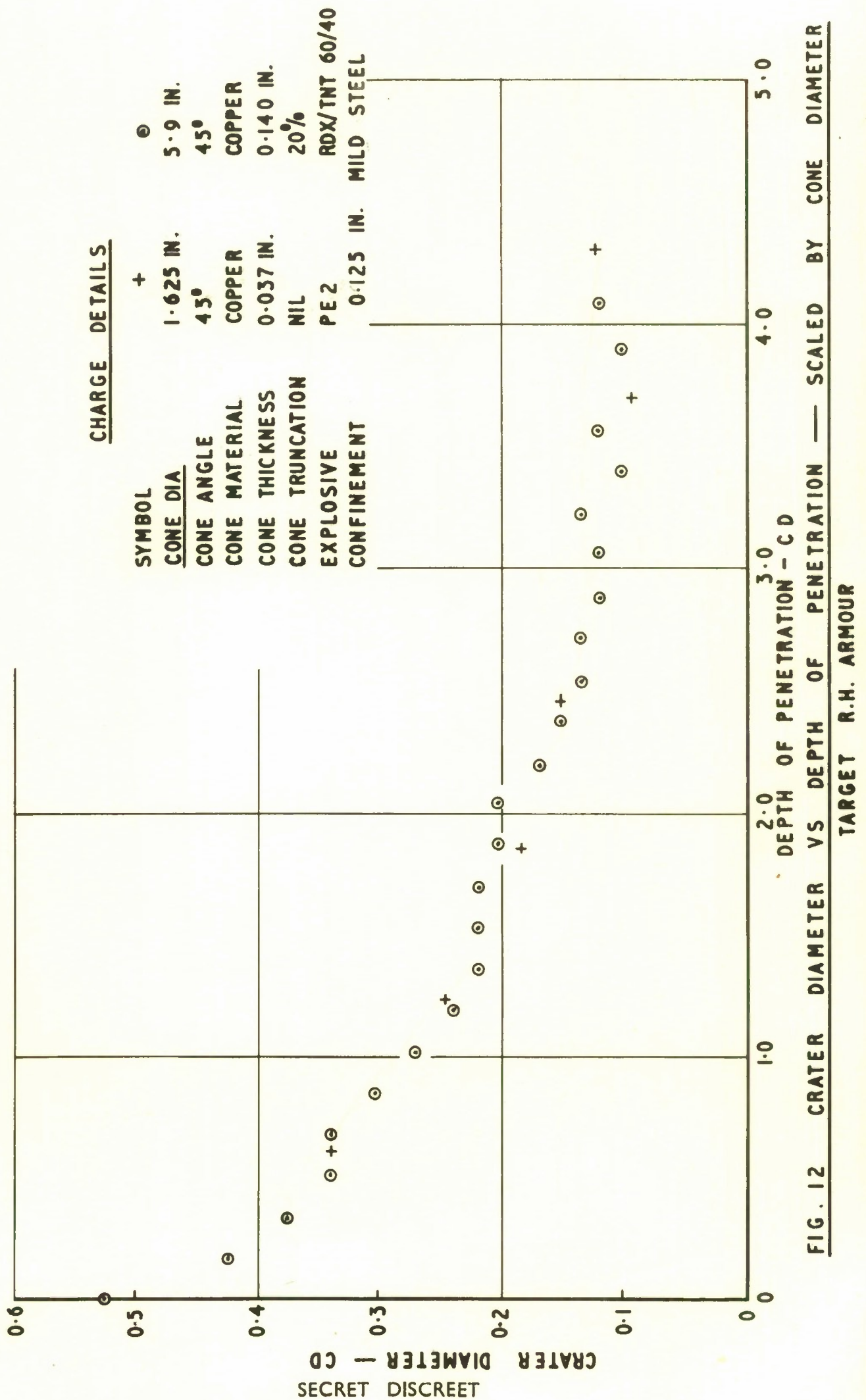


FIG. 11 CRATER VOLUME VS WALL THICKNESS
TARGET R.H. ARMOUR



SECRET DISCREET

CRATER DIAMETER - INCHES

FIG. 13

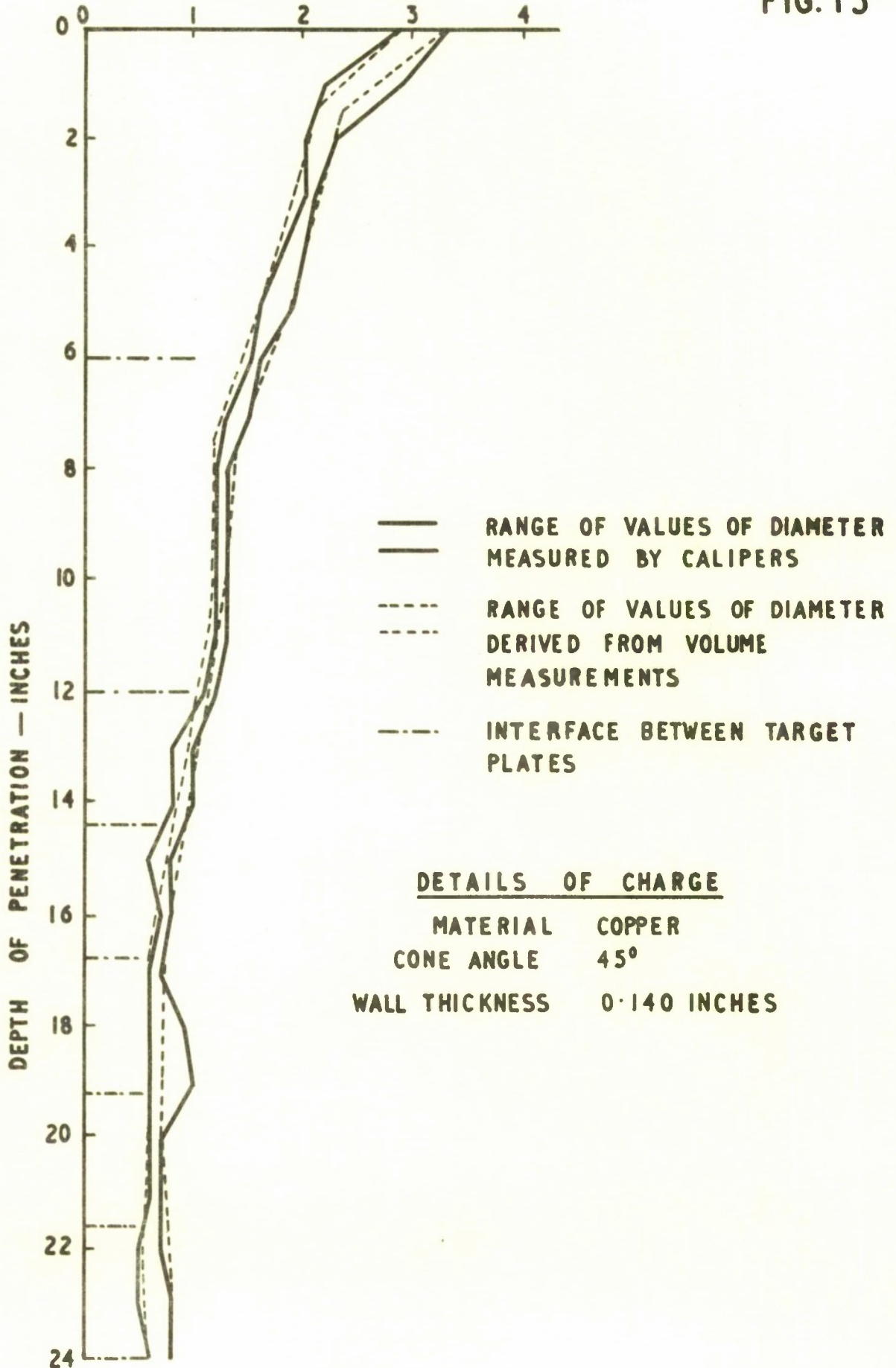


FIG. 13 COMPARISON OF CRATER DIAMETERS MEASURED BY CALIPERS AT 1 INCH INTERVALS OF PENETRATION WITH VALUES OF CRATER DIAMETER DERIVED FROM MEASUREMENTS OF CRATER VOLUME AT 3 INCH INTERVALS OF PENETRATION

SECRET DISCREET

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